United States
Department of
Agriculture

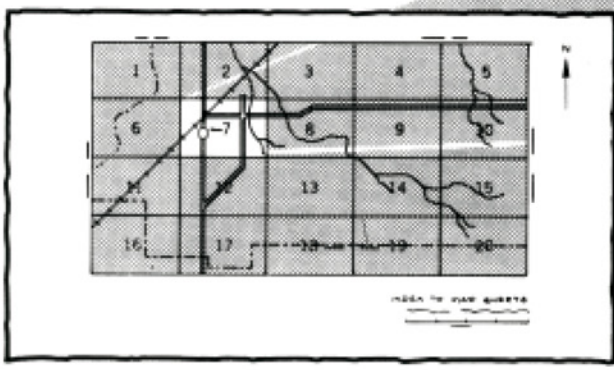
Soil
Conservation
Service

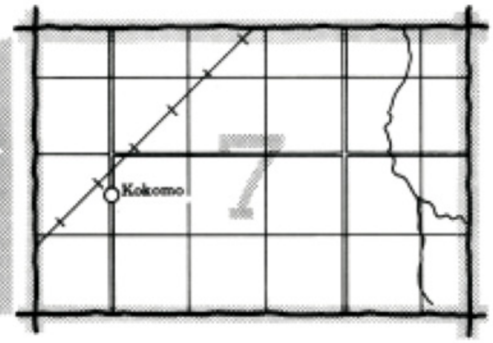
In cooperation with
United States Department
of Agriculture,
Forest Service, and
the Texas Agricultural
Experiment Station

Soil Survey of Polk and San Jacinto Counties, Texas

HOW TO USE

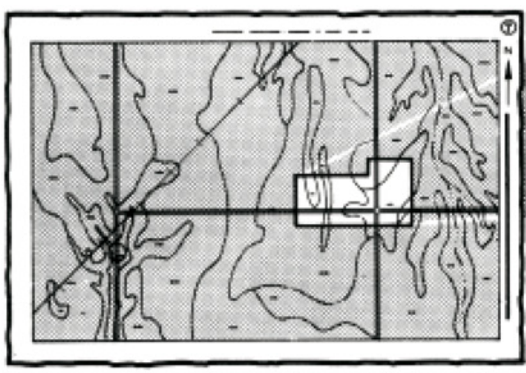
1. Locate your area of interest on the "Index to Map Sheets"

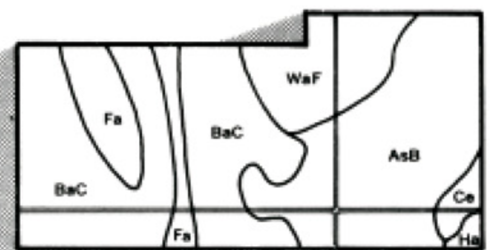




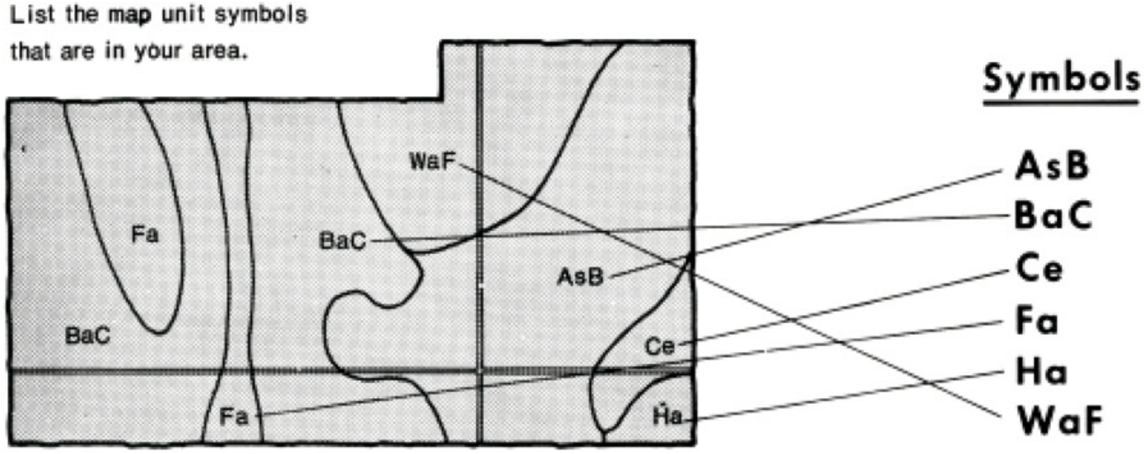
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



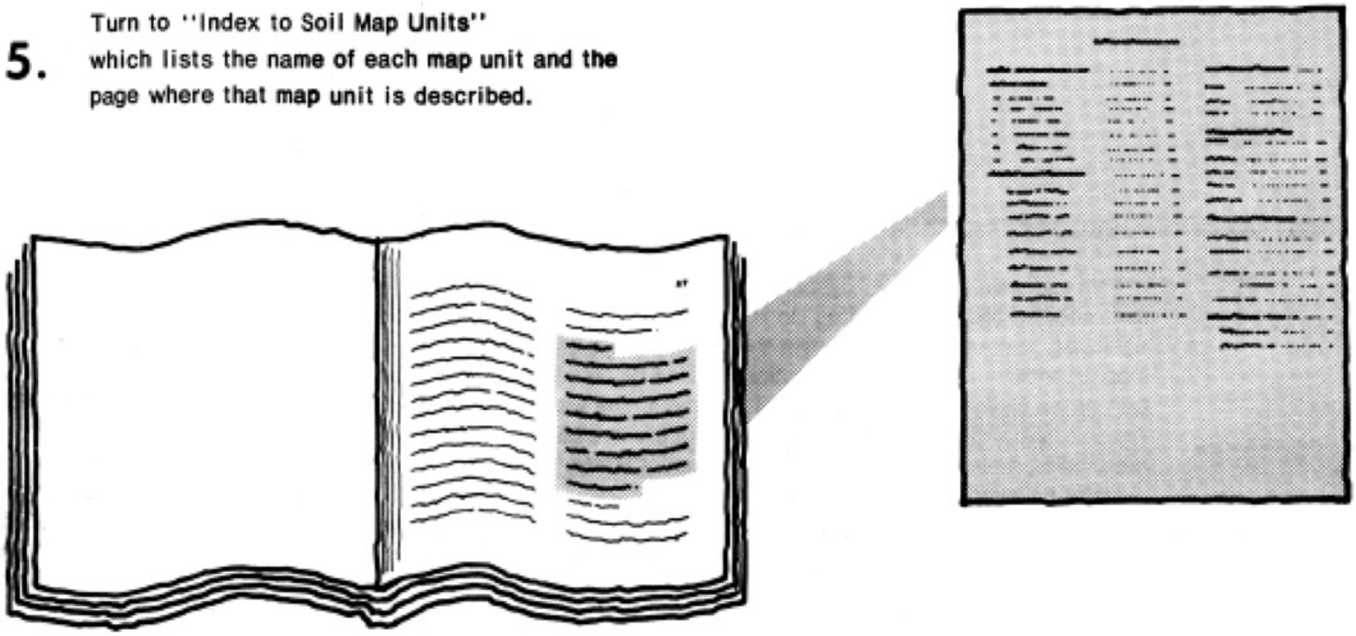


4. List the map unit symbols that are in your area.

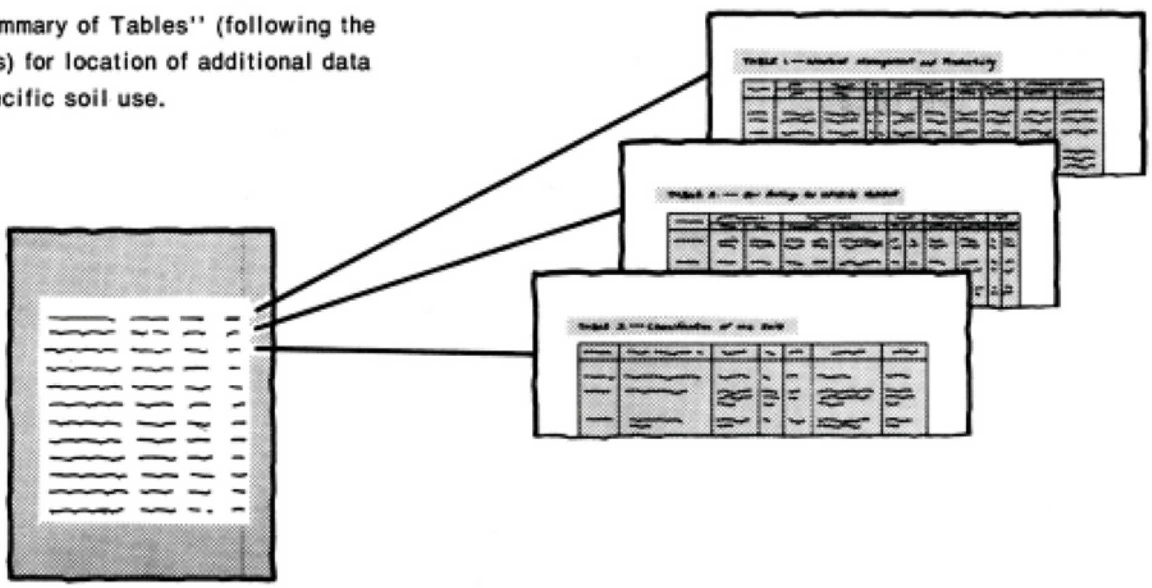


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1981. Soil names and descriptions were approved in 1983. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1983. This soil survey was made cooperatively by the United States Department of Agriculture, Soil Conservation Service and Forest Service, the Texas Agricultural Experiment Station, and the Texas State Soil and Water Conservation Board. It is part of the technical assistance furnished to the Polk-San Jacinto Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

This survey updates the soil survey of Polk County published in 1930. Descriptions, names, and delineations of soils in Polk and San Jacinto Counties do not fully agree with those on the soil maps of adjacent Montgomery and Walker Counties. Differences are the result of better knowledge of soils, modifications in series concepts, intensity of mapping, or the extent of the soils in the survey area.

Cover: This pine forest on Betis loamy fine sand, 1 to 5 percent slopes, is typical of the area.

Contents

Soil Series

Index to Map Units

Summary of Tables

Foreword

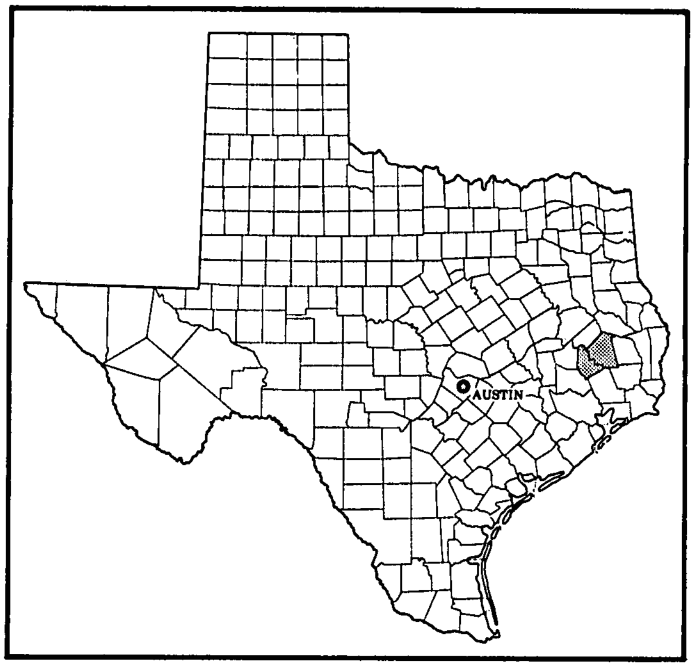
This soil survey contains information that can be used in land-planning programs in Polk and San Jacinto Counties. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Harry W. Oneth
State Conservationist
Soil Conservation Service



Location of Polk and San Jacinto Counties in Texas.

Soil Survey of Polk and San Jacinto Counties, Texas

By Harry McEwen, Kirby Griffith, and
Jesse D. Deshotels, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service
In cooperation with
United States Department of Agriculture, Forest Service,
and the Texas Agricultural Experiment Station

General Nature of the Counties

POLK and SAN JACINTO COUNTIES are in southeastern Texas. These counties have an area of 1,110,490 acres, or 1,735 square miles, including 64,967 acres of water. The largest acreage of water is Lake Livingston, which is fed by the Trinity River. Other major waterways in the counties are the Neches River, East Fork San Jacinto River, Long King Creek, Big Sandy Creek, Piney Creek, Menard Creek, and Winters Bayou. The Trinity River is the boundary between the two counties.

Livingston is the county seat of Polk County, and Coldspring is the county seat of San Jacinto County. The major towns in Polk County are Corrigan, Goodrich, Onalaska, and Seven Oaks, and in San Jacinto County, they are Oakhurst, Point Blank, and Shepherd.

Elevation in the two counties ranges from 40 feet where the Trinity River leaves the area to 485 feet in the northeastern part of Polk County.

History

John Davidson, district conservationist, Soil Conservation Service, assisted in preparing this section.

On March 20, 1846, in its first legislative session, the State of Texas created Polk County that was then a part of Liberty County. Polk County was named in honor of President James K. Polk. San Jacinto County was established in 1870 from parts of Polk, Liberty, Montgomery, and Walker Counties. It was named in honor of the Battle of San Jacinto.

Since the 1780's, the Alabama-Coushatta Indians have resided in the Big Thicket area. These Indians were originally from Alabama. The Big Thicket area with its dense cover provided abundant game and shelter. The Indians laid out effective trails that became roads used by the early settlers who settled along these routes. Since the 1850's, the Alabama-Coushatta Indians have lived on a reservation located east of Livingston on U.S. Highway 190.

The early commerce in Polk and San Jacinto Counties moved by way of the Trinity River. River landings, such as Patricks Ferry, Drews Landing, and Swartout, were important trading and travel points for the early settlers. Later, the railroads became established and most trade was moved in and out by rail.

Early agricultural production was centered around cotton and corn. Soils on the bottom lands of the Trinity River were the most productive farmland. Sandy soils on the uplands have been cropped in the past with varying results. According to the 1929 census, cotton yielded 1/3 bale per acre with most of the higher yields coming from the bottom lands of the Trinity River.

In the 1860's the timber industry began to flourish. During this period, it was common practice to harvest timber and raft them down the Trinity River to the mills. A large mill was located at the mouth of Big Creek in San Jacinto County and was kept supplied by logs rafted down the Trinity River. After the railroads were built, it became possible to cut timber all over Polk and San Jacinto Counties. Because of the access created by the railroads, mills were established in many communities.

Natural Resources

Soil, water, oil, gas, and possibly coal and iron ore are the most important natural resources in Polk and San Jacinto Counties. The area's wildlife is also important. Soil is basic to the production of timber and forage for

livestock and to the production of food for market or home consumption.

Water is not commonly used for irrigation but is available and plentiful for industrial, recreational, and domestic growth.

Oil and gas are produced from numerous wells in the survey area. They are a major source of income to some of the landowners and serve as a solid tax base for revenue to operate public facilities.

Iron ore is mainly used as material for road surfacing. Lignite coal is present in the area; however, it is undeveloped.

Wildlife provides recreation and is a source of income for many landowners.

Agriculture and Forestry

Polk and San Jacinto Counties are about 77 percent woodland, 12 percent pastureland or hayland, 6 percent water, 3 percent cropland, and 2 percent towns, parks and other built-up areas *(17)*.

Timber and its by-products are the main economic enterprises. Most timber is owned by timber companies and the United States Department of Agriculture, Forest Service. The timber is managed for pulpwood, lumber, and pole production.

Cow-calf ranch operation is the most common livestock enterprise. Stocker calves are marketed through local and nearby auction facilities. Feeding of protein supplement is necessary for winter maintenance of cattle.

Most of the cropland is used for introduced or improved grasses for grazing and hay. Only a small acreage is used for row crops. This acreage is mainly small fields of corn and vegetable gardens. Soybeans make up a small acreage.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

The Polk and San Jacinto County area has long, hot summers because moist tropical air from the Gulf of Mexico persistently covers the area. Winters are cool and fairly short with only a rare cold wave that moderates in 1 or 2 days. Precipitation is distributed fairly evenly throughout the year, and prolonged droughts are rare, summer precipitation, mainly afternoon thundershowers, is adequate for all crops.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Livingston in the period 1951 to 1976. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 51 degrees F, and the average daily minimum temperature is 39 degrees. The lowest temperature on record, which occurred at Livingston on February 2, 1951, is 4 degrees. In summer the average temperature is 81 degrees, and the average daily maximum temperature is 93 degrees. The highest recorded temperature, which occurred at Livingston on August 6, 1951, is 111 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 48.47 inches. Of this, 25 inches, or 52 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 19 inches. The heaviest 1-day rainfall during the period of record was 9.8 inches at Livingston on August 6, 1951. Thunderstorms occur on about 70 days each year, and most occur in summer.

Snowfall is rare. In 70 percent of the winters, there is no measurable snowfall. In 10 percent, the snowfall, usually of short duration, is more than 2 inches. The heaviest 1-day snowfall on record was more than 3 inches.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 90 percent. The sun shines 60 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the south-southeast. Average windspeed is highest, 9 miles per hour, in spring.

Severe local storms, including tornadoes, strike occasionally in or near the area. They are of short duration and cause variable and spotty damage. Every few years in summer or autumn, a tropical depression or remnant of a hurricane which has moved inland causes extremely heavy rains for 1 to 3 days.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material from which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area are generally collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on pasture yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. In the detailed soil map units, these latter soils are called inclusions or included soils. In the general soil map units, they are called soils of minor extent.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed, and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soils on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or a building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The fifteen general soil map units in Polk and San Jacinto Counties make up about 94 percent of the survey area. The remaining acreage is water.

Moderately well drained to somewhat poorly drained, loamy, sandy, and clayey soils; on uplands.

The seven general soil map units in this group make up about 66 percent of the survey area. These map units are well dissected by creeks and drainageways. The topography mainly is nearly level to rolling. Most areas are in woodland and are used for loblolly, shortleaf, and longleaf pines. Some areas are in pastures of bahiagrass or bermudagrass.

1. Pinetucky-Doucette

Gently sloping, moderately well drained and well drained, moderately slowly permeable and moderately permeable, loamy and sandy soils

This map unit makes up about 23 percent of the survey area. It is about 36 percent Pinetucky soils, 26 percent Doucette soils, and 38 percent soils of minor extent.

The soils in this map unit are in broad areas across the central part of the survey area. Slopes range from 1 to 5 percent. The landscape is characterized by broad, gently sloping ridges that are separated by well defined drainageways and creeks that flow southward. It has a mixed pine and hardwood forest cover. The soils formed in the highly weathered, strongly leached, loamy material of the Willis Formation.

The moderately well drained, moderately slowly permeable Pinetucky soils generally are on ridgetops and side slopes. The surface layer is medium acid grading to very strongly acid.

Typically, the Pinetucky soils have a fine sandy loam surface layer about 12 inches thick. The surface layer is dark grayish brown in the upper part and pale brown in the lower part. The subsoil extends to a depth of about 70 inches. The upper part of the subsoil, to a depth of 28 inches, is yellowish brown clay loam. The middle part, to a depth of 56 inches, is yellowish brown sandy clay loam that contains plinthite and mottles in shades of red and brown. The lower part is yellowish brown sandy clay loam that contains plinthite, gray mottles, and mottles in shades of red and brown.

The well drained, moderately permeable Doucette soils generally are on the ridgetops. The surface layer is medium acid grading to very strongly acid. The subsoil is very strongly acid throughout.

Typically, the Doucette soils have a loamy fine sand surface layer about 24 inches thick. The surface layer is dark grayish brown in the upper part and grades to pale brown in the lower part. The subsoil to a depth of about 70 inches is sandy clay loam that is strong brown in the upper part and grades to mottled strong brown, yellowish red, and light gray in the lower part.

Soils of minor extent in this map unit are Betis, Bonwier, Boykin, Choates, Dallardsville, Kian, Leggett, Pluck, Stringtown, and Woodville soils. Betis and Boykin soils are on a few of the ridgetops. Bonwier, Stringtown, and Woodville soils are on steeper side slopes adjacent to drainageways. Choates, Dallardsville, and Leggett soils are near the head of drainageways and on foot slopes. Kian and Pluck soils are on the flood plains of the many creeks that cross the area.

The soils in this map unit are used mainly as woodland. Loblolly, shortleaf, longleaf, and slash pines do well on the Doucette soils. Loblolly and shortleaf pines and hardwoods, such as black walnut, sweetgum, and water oak, do well on the Pinetucky soils.

Some areas of this map unit are in pastures of bermudagrass (fig. 1) and bahiagrass. These grasses are also harvested for hay.

The soils in this map unit can be used as cropland; however, only a few small areas are in cultivated crops. These areas are mainly vegetable gardens near homes.

The soils of this map unit are suited to most urban uses.

2. Woodville-Pinetucky

Gently sloping to strongly sloping, somewhat poorly drained and moderately well drained, very slowly permeable and moderately slowly permeable, loamy soils

This map unit makes up about 18 percent of the survey area. It is about 62 percent Woodville soils, 17 percent Pinetucky soils, and 21 percent soils of minor extent.

The soils in this map unit are in broad areas across the central part of the survey area. Slopes range from 1 to 12 percent. The landscape is characterized by broad, gently sloping ridges and strongly sloping side slopes. The ridges are separated by well defined drainageways and creeks that flow southward. It has a mixed pine and hardwood forest cover. These soils mainly formed in the lime-rich clays of the Fleming Formation and in the highly weathered, strongly leached, loamy material of the Willis Formation.

The somewhat poorly drained, very slowly permeable Woodville soils are generally on side slopes. Reaction is medium acid in the surface layer, strongly acid or very strongly acid to a depth of 65 inches, and below that, it is moderately alkaline. A seasonal high water table is at a depth of 2.5 to 4 feet during the winter.

Typically, the Woodville soils have a fine sandy loam surface layer about 6 inches thick. It is brown in the upper part of the surface layer and pale brown in the lower part. The subsoil extends to a depth of about 70 inches. It is clay that is mottled brown, yellow, and red in the upper part of the subsoil and light gray in the lower part.

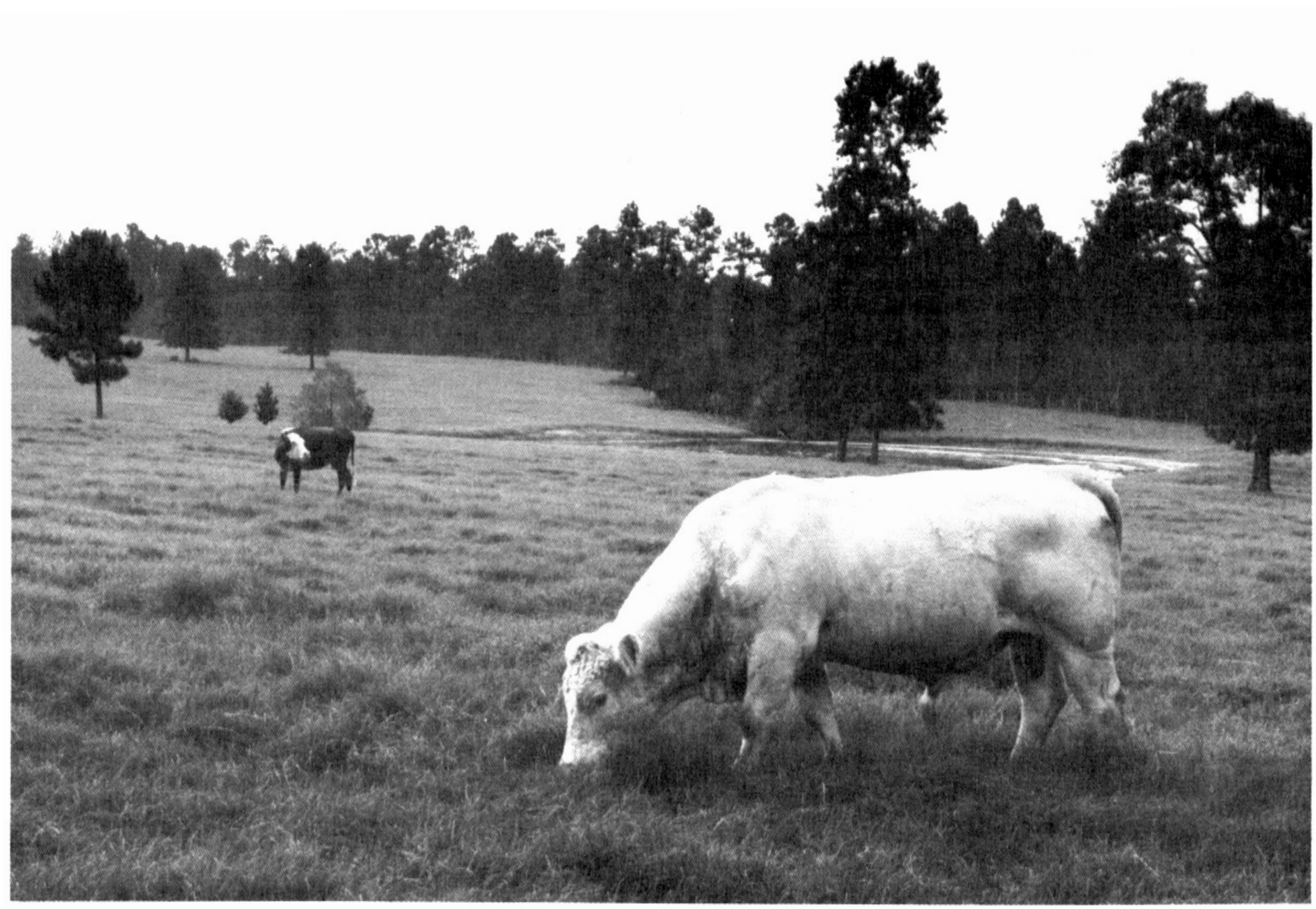


Figure 1.—An excellent pasture of improved bermudagrass in an area of Pinetucky fine sandy loam, 1 to 5 percent slopes.

The moderately well drained, moderately slowly permeable Pinetucky soils are mainly on ridgetops and on some upper side slopes. The surface layer is medium acid grading to very strongly acid.

Typically, the Pinetucky soils have a fine sandy loam surface layer about 12 inches thick. It is dark grayish brown in the upper part of the surface layer and pale brown in the lower part. The subsoil extends to a depth of about 70 inches. The upper part of the subsoil, to a depth of 28 inches, is yellowish brown clay loam. The middle part, to a depth of about 56 inches, is yellowish brown sandy clay loam that contains plinthite and mottles in shades of red and brown. Below that is yellowish brown sandy clay loam that contains plinthite, gray mottles, and mottles in shades of red and brown.

Soils of minor extent in this map unit are Bonwier, Boykin, Dallardsville, Doucette, Kian, Leggett, Moswell, Pluck, and Stringtown soils. Bonwier, Moswell, and Stringtown soils are on the steeper side slopes. Boykin soils are on some of the ridgetops. Dallardsville, Doucette, and Leggett soils are near heads of drainageways and on foot slopes. Kian and Pluck soils are on the flood plains of the many creeks that cross the survey area.

The soils in this map unit are used mainly as woodland. Loblolly, shortleaf, and slash pines and hardwoods, such as sweetgum, do well on these soils.

Some areas of this map unit are in pastures of bermudagrass and bahiagrass. These grasses are also harvested for hay.

The Pinetucky and Woodville soils that have slopes of less than 5 percent can be used as cropland. The Woodville soils that have slopes more than 5 percent are too highly erodible to be plowed. Presently, only a few small areas are in vegetable gardens.

The high shrink-swell potential, low strength, and seasonal high water table restrict urban and recreation uses of the Woodward soils.

3. Laska-Colita-Oakhurst

Nearly level to strongly sloping, moderately well drained and somewhat poorly drained, moderately rapidly permeable, moderately permeable, and very slowly permeable, loamy soils

This map unit makes up about 12 percent of the survey area. It is about 21 percent Laska soils, 19 percent Colita soils, 16 percent Oakhurst soils, and 44 percent soils of minor extent.

The soils in this map unit are in a broad expanse across the northern part of the survey area. Slopes range from 0 to 8 percent. The landscape is characterized by broad, nearly level areas and gently sloping ridges and strongly sloping side slopes. The soils in this map unit are on the highest part of the survey area in which the drainage pattern drains both to the north and to the south. This area has a mixed pine and hardwood forest cover but has a more open understory than is in most areas. These soils formed in mudstone, siltstone, sandstone, and shale of the highly tuffaceous Catahoula Formation.

The moderately well drained, moderately rapidly permeable Laska soils are mainly on low ridges and knolls. The reaction is strongly acid grading to slightly acid. A seasonal high water table is at a depth of 1.5 to 3 feet during the winter.

Typically, the Laska soils have a fine sandy loam surface layer about 19 inches thick. It is grayish brown in the upper part of the surface layer and grades to brown in the lower part. The subsoil extends to a depth of 83 inches. It is very pale brown fine sandy loam in the upper part and a pale brown loamy very fine sand in the lower part. The substratum to a depth of 85 inches is a very pale brown fine sandy loam.

The somewhat poorly drained, moderately permeable Colita soils are on the flatter, smoother parts of the landscape. Reaction is strongly acid or very strongly acid throughout. A perched water table is near the surface during the winter and spring.

Typically, the Colita soils have a fine sandy loam surface layer about 16 inches thick. It is grayish brown in the upper part of the surface layer and light grayish brown in the lower part. The subsoil, to a depth of 47 inches, is grayish brown very fine sandy loam in the upper part, and in the lower part, it grades to gray silty clay loam that is mixed with darker very fine sandy loam from the surface layer. The next layer, to a depth of 50 inches, is gray clay loam that is mixed with very fine sandy loam from the surface. The substratum to a depth of 60 inches is light brownish gray siltstone.

The somewhat poorly drained, very slowly permeable Oakhurst soils are on side slopes and some broad ridges. These soils are strongly acid grading to mildly alkaline. A perched water table is near the surface during the winter.

Typically, Oakhurst soils have a very fine sandy loam surface layer about 7 inches thick. It is dark gray in the upper part and grayish brown in the lower part. The subsoil, to a depth of 46 inches, is clay. It is dark grayish brown in the upper part of the subsoil and gray in the lower part. The substratum to a depth of 65 inches is a light gray volcanic tuff of silty clay loam texture.

Soils of minor extent in this map unit are Burkeville, Colita Variant, Diboll, Herty, Keltys, Kian, Kitterll, Leggett, Mantachie, Moswell, Pluck, Rayburn, Wiergate, and Woodville soils. The Burkeville, Wiergate, and Woodville soils are on side slopes mainly along the southern boundary of the map unit. The Colita Variant, Diboll, and Leggett soils are in the smoother, lower positions on the landscape. The Herty, Keltys, and Moswell soils are on side slopes in the northern part of the map unit. The Kitterll soils are on scattered high points of the landscape. Kian, Mantachie, and Pluck soils are on flood plains. Rayburn soils are on side slopes throughout the map unit.

The soils in this map unit are used mainly as woodland. Loblolly, shortleaf, and slash pine grow on these soils. Hardwoods, such as sweetgum and water oak, do well on these soils. Southern red oak grows well on the Laska soils.

A small acreage is in pastures of bahiagrass and bermudagrass. Pastures are difficult to manage on Colita soils.

The soils in this map unit are not used as cropland. A few vegetable gardens are near homes.

The soils in this map unit are moderately suited to most urban and recreation uses because of the seasonal high water table and soil drainage. Also, the high shrink-swell potential of the Oakhurst soils is a limitation to urban and recreation uses.

4. Wiergate-Burkeville-Woodville

Gently sloping to strongly sloping, somewhat poorly drained, very slowly permeable, clayey and loamy soils

This map unit makes up about 5 percent of the survey area. It is about 63 percent Wiergate soils, 16 percent Burkeville soils, 16 percent Woodville soils, and 5 percent soils of minor extent.

The soils in this map unit are in many small areas in the central part of the survey area. Slopes range from 1 to 15 percent. The landscape is characterized by gentle hills and numerous short drainageways that are notched into the side slopes. Creeks and through-flowing streams are generally not common to these areas. Many of the current drainageways resulted from man's disturbance of the vegetative cover. This allowed water to remove the highly erodible soil and to form gullies.

This map unit acreage was originally a tall grass prairie with only a few hardwood trees along drainageways. The prairie sod was more easily plowed out by pioneers than the surrounding forest, therefore, the soils of this map unit were some of the first to be planted to cotton, corn, and other crops. These soils formed in lime-rich clay of the Fleming Formation, therefore, good crops could be produced without applying lime to the soil. Unfortunately, the soils are highly erodible and were eventually abandoned as cropland. The surrounding pine and hardwood forest is now encroaching on this map unit area.

The Wiergate soils are on ridgetops and gently sloping to sloping side slopes. The surface layer is mildly alkaline and the lower layers are moderately alkaline and calcareous. A perched water table is within 2 feet of the surface during the winter.

Typically, the surface layer of the Wiergate soils is very dark gray clay about 12 inches thick. The subsoil, to a depth of 36 inches, is olive gray clay. The next layer to a depth of 60 inches is pale olive clay.

The Burkeville soils are on sloping to strongly sloping side slopes. These soils are moderately alkaline and calcareous throughout. A perched water table is near the surface during the winter.

Typically, the surface layer of the Burkeville soils is grayish brown clay about 5 inches thick. The underlying material, to a depth of 60 inches, is clay. It is light brownish gray in the upper part of the underlying material and pale olive in the lower part.

The Woodville soils are on gently sloping to strongly sloping side slopes below the Burkeville and Wiergate soils. The reaction is medium acid in the surface layer, strongly or very strongly acid to a depth of 65 inches, and below that, it is moderately alkaline. A seasonal high water table is at a depth of 2.5 to 4 feet during the winter.

Typically, the surface layer of the Woodville soils is fine sandy loam about 6 inches thick. It is brown in the upper part and pale brown in the lower part. The subsoil to a depth of 70 inches is clay that is mottled brown and red in the upper part and light gray in the lower part.

Soils of minor extent in this map unit are Garner, Oakhurst, and Pinetucky soils. Garner soils are in a few level areas. Oakhurst soils are intermingled with Woodville soils in some areas. Pinetucky soils are on ridgetops where they have formed in remnants of the loamy Willis Formation.

The soils in this map unit are mostly used as low quality woodland and pastureland. These soils are moderately suited to loblolly and shortleaf pines. Several areas are in improved bermudagrass pastures.

The soils in this map unit are poorly suited to most urban and recreation uses because of high shrink-swell potential, low strength, seasonal high water table, clay texture, and slope.

5. Conroe

Gently sloping, moderately well drained, slowly permeable, gravelly and sandy soils

This map unit makes up about 4 percent of the survey area. It is about 69 percent Conroe soils and 31 percent soils of minor extent.

The soils in this map unit are in southwestern San Jacinto County. Slopes range from 1 to 5 percent. The landscape is characterized by broad, gently undulating ridges that are dissected by small creeks. It has a mixed pine and hardwood forest cover that has a sparse understory. These soils formed in the highly weathered, strongly leached, loamy material of the Willis Formation.

These soils are very strongly acid throughout. A perched water table is at a depth of 2 to 3.5 feet during the winter and spring.

Typically, the Conroe soils have a gravelly loamy fine sand surface layer about 22 inches thick. It is dark gray in the upper part and light yellowish brown in the lower part. The subsoil to a depth of 60 inches is yellowish brown sandy clay loam and sandy clay in the upper part and mottled light gray, light brownish gray, and brownish yellow sandy clay in the lower part.

Soils of minor extent in this map unit are Betis, Boykin, Choates, Dallardsville, Kian, Kirbyville, Otanya, Pinetucky, and Pluck soils. Betis, Boykin, Otanya, and Pinetucky soils are in similar ridge positions on the landscape as Conroe soils. Choates and Dallardsville soils are near the head of drainageways and toe slopes. Kirbyville soils are on low ridges and side slopes. Kian and Pluck soils are on the flood plains of creeks.

The soils in this map unit are mainly used as woodland. Trees that can be planted on these soils are mainly loblolly, shortleaf, longleaf, and slash pines. A few areas are mined for the surface gravel. A few pastures are planted to bermudagrass or bahiagrass. The soil is droughty during the summer. Lime and fertilizers must be added to increase production.

The soils in this map unit are moderately suited to most urban and recreation uses. The sandy surface, slow permeability, and seasonal wetness are factors to be considered.

6. Diboll-Moswell-Keltys

Nearly level to strongly sloping, somewhat poorly drained and moderately well drained, very slowly permeable and slowly permeable, silty and loamy soils

This map unit makes up about 3 percent of the survey area. It is about 30 percent Diboll soils, 25 percent Moswell soils, 20 percent Keltys soils, and 25 percent soils of minor extent.

The soils in this map unit are in the northern part of Polk County. Slopes range from 0 to 12 percent. The landscape is characterized by broad, level to gently sloping ridges and subdued drainageways. The soils on the more strongly sloping side slopes drain into a dissected drainageway that mainly flows into Piney Creek. These soils formed in tuffaceous siltstones, sandstones, and shales of the Willborn, Manning, and Whitsett Formations. These materials weather to acid soils that cause a chemical imbalance in pine seedlings, such as aluminum toxicity or excess soluble salts.

The nearly level to gently sloping, somewhat poorly drained Diboll soils are in the smoother, more level areas. They are very slowly permeable. These soils are very strongly acid and the siltstone is slightly acid. The subsoil has in excess of 15 percent exchangeable sodium. A perched water table is near the surface during the winter and spring.

Typically, the Diboll soils have a surface layer that is grayish brown silt loam about 5 inches thick. The subsurface layer is light brownish gray very fine sandy loam to a depth of 22 inches. The subsoil, to a depth of 49 inches, is grayish brown silt loam that has streaks of very fine sandy loam in the upper part, and it is light yellowish brown clay loam in the lower part. The substratum is light yellowish brown siltstone.

The gently sloping to strongly sloping, moderately well drained Moswell soils are on the steeper side slopes. They are very slowly permeable. The surface layer is strongly acid and all layers below are extremely acid.

Typically, Moswell soils have a surface layer of very dark grayish brown fine sandy loam about 5 inches thick. The subsoil extends to a depth of about 47 inches. The upper part of the subsoil is yellowish red clay, and the lower part is mottled dark reddish brown and yellow clay. The substratum is brownish yellow shaly clay.

The gently sloping, moderately well drained Keltys soils are on ridges and side slopes. They are slowly permeable. These soils are strongly or medium acid grading to strongly acid.

Typically, the Keltys soils have a very fine sandy loam surface layer about 29 inches thick. It is dark brown in the upper part and pale brown in the lower part. The subsoil, to a depth of about 55 inches, is grayish brown fine sandy loam in the upper part grading to grayish brown, gray, and yellowish brown sandy clay loam in the lower part. The subsoil is mixed with about 30 percent gray or brown very fine sandy loam. The underlying material is siltstone.

Soils of minor extent in this map unit are Herty, Kian, Mantachie, Ozias, and Pophers soils. Herty soils are in the same positions on the landscape as Diboll soils. The remaining minor soils are on flood plains of streams.

The soils in this map unit are used mostly as woodland. Loblolly and slash pines and hardwoods, such as sweetgum and water oak, can be grown on these soils. In addition, shortleaf pines do well on the Keltys soils. Seedling mortality is severe on the Diboll soils. Improved pastures do not adapt well to the Diboll soils, but bermudagrass and bahiagrass are suited to the Moswell and Keltys soils.

Permeability and wetness reduce the suitability of the soils in this map unit for urban and recreation uses.

7. Moswell-Keltys

Gently sloping to strongly sloping, moderately well drained, very slowly permeable and slowly permeable, loamy soils

This unit makes up about 1 percent of the survey area. It is about 75 percent Moswell soils, 20 percent Keltys soils, and 5 percent soils of minor extent.

The soils in this map unit are in the northern part of Polk County. Slopes range from 1 to 12 percent. The landscape is characterized by well dissected ridges and drainageways that flow north to the Neches River or south to Piney Creek. These soils formed in tuffaceous siltstone, sandstones, and shales of the Wellborn, Manning, and Whitsett Formations. These materials weather to acid soils.

The gently sloping to strongly sloping Moswell soils are on the more sloping side slopes. They are very slowly permeable. The surface layer is strongly acid and all layers below are extremely acid.

Typically, the Moswell soils have a surface layer of very dark grayish brown fine sandy loam about 5 inches thick. The subsoil to a depth of about 47 inches is yellowish red clay in the upper part, and in the lower part, it is mottled dark reddish brown and yellow clay. The substratum is brownish yellow shaly clay.

The gently sloping Keltys soils are on ridgetops and side slopes. They are slowly permeable. These soils are strongly acid or medium acid grading to strongly acid.

Typically, the Keltys soils have a very fine sandy loam surface layer about 29 inches thick. It is dark brown in the upper part of the surface layer and pale brown in the lower part. The subsoil, to a depth of 55 inches, is grayish brown fine sandy loam in the upper part grading to grayish brown, gray, and yellowish brown sandy clay loam in the lower part. The subsoil is mixed with about 30 percent gray or brown very fine sandy loam. The substratum to a depth of about 65 inches is siltstone.

Soils of minor extent in this map unit are Diboll, Kian, Mantachie, Ozias, and Pophers soils. The Diboll soils are in flatter, smoother areas. The remaining minor soils are on flood plains of streams.

The soils in this map unit are used mainly as woodland. Loblolly and slash pines and hardwoods, such as sweetgum and water oak, grow on these soils. A few areas are in pastures of bahiagrass and bermudagrass.

The soils in this map unit are poorly suited to most urban and recreation uses because of the high shrink-swell potential, low strength, and seasonal high water table.

Moderately well drained to poorly drained, loamy, sandy, and silty soils: on flatwoods

The two general soil map units in this group make up about 12 percent of the survey area. These map units are poorly dissected by widely spaced, shallow drainageways. The topography mainly is nearly level to gently sloping. Most areas are in woodland and are used for loblolly and shortleaf pines. Some areas are used for hardwoods. A small acreage is in pastureland and hayland, mainly bahiagrass and bermudagrass.

8. Otanya-Kirbyville-Dallardsville

Nearly level to gently sloping, moderately well drained and somewhat poorly drained, moderately slowly permeable and moderately permeable, loamy and sandy soils

This map unit makes up about 9 percent of the survey area. It is about 29 percent Otanya soils, 20 percent Kirbyville soils, 19 percent Dallardsville soils, and 32 percent soils of minor extent.

The soils in this map unit are in the southern part of the survey area. Slopes range from 0 to 3 percent. The landscape is characterized by broad, smooth, nearly level and gently sloping areas that have poorly defined drainage patterns. Creeks have narrow, shallow channels that are generally clogged by brush and trees. These areas have a mixed hardwood and pine forest cover that has a dense understory. These soils formed in loamy sediment of the Bentley Formation. This material weathers to acid soils.

The moderately well drained, moderately slowly permeable Otanya soils are in the slightly higher positions on the landscape. The reaction is slightly acid and grades to very strongly acid. A perched water table is at a depth of 3 to 5 feet during the winter.

Typically, the Otanya soils have a fine sandy loam surface layer about 9 inches thick. It is dark grayish brown in the upper part and very pale brown in the lower part. The subsoil to a depth of 65 inches is strong brown sandy clay loam.

The somewhat poorly drained, moderately permeable Kirbyville soils are on the barely discernable lower side slopes and in the flat areas. Reaction is medium acid grading to very strongly acid. A seasonal high water table is at a depth of 1.5 to 2.5 feet during the winter.

Typically, the Kirbyville soils have a fine sandy loam surface layer about 12 inches thick. It is dark grayish brown in the upper part and light yellowish brown in the lower part. The subsoil to a depth of 72 inches is sandy clay loam that is yellowish brown in the upper part and brownish yellow in the lower part.

The somewhat poorly drained, moderately slowly permeable Dallardsville soils are on flats and around heads of the ill-defined drainageways. These soils are very strongly acid or extremely acid throughout. A perched water table is at a depth of 1 foot to 2 feet during the winter and spring.

Typically, the Dallardsville soils have a loamy very fine sand surface layer about 19 inches thick. It is grayish brown in the upper part, pale brown in the middle part, and very pale brown in the lower part. The subsoil to a depth of 70 inches is light gray loamy very fine sand tongued and mixed with pale brown very fine sandy loam grading to light gray clay loam.

Soils of minor extent in this map unit are Boykin, Choates, Kian, Pluck, Sorter, and Waller soils. Boykin soils are on high points on the landscape. Choates soils are on foot slopes. Kian and Pluck soils are on flood plains of creeks. Sorter and Waller soils, which comprise more than 40 percent of the minor soils, are in the lower, flatter, depressional, most poorly drained positions on the landscape.

The soils in this map unit are used mainly as woodland. Loblolly and slash pines mostly are grown on these soils. Also, longleaf pine does well on the Otanya soils. Hardwood trees that grow well on these soils are sweetgum and water oaks. A small acreage is in pastures of mainly bermudagrass and bahiagrass.

The seasonal high water table lowers the suitability of these soils for urban and recreation uses.

9. Sorter-Otanya-Waller

Nearly level to gently sloping, poorly drained and moderately well drained, slowly permeable and moderately slowly permeable, silty and loamy soils

This map unit makes up about 3 percent of the survey area. It is about 55 percent Sorter soils, 14 percent Otanya soils, 12 percent Waller soils, and 19 percent soils of minor extent.

The soils in this map unit are in the southern part of San Jacinto County. Slopes range from 0 to 3 percent. The landscape is characterized by broad, smooth, nearly level areas and some gently sloping areas. Drainage areas are poorly defined, and they require many days to drain. Water-loving hardwood trees are prevalent in the poorly drained areas. Pines are more prevalent in the better drained areas. These soils formed in loamy sediment of the Bentley Formation. This material weathers to acid soils.

The poorly drained, slowly permeable Sorter soils are on broad, smooth, nearly level areas. Reaction is medium acid throughout. A perched water table is within 2.5 feet of the surface from October to May, and water is on the soil surface for extended periods.

Typically, the Sorter soils have a grayish brown silt loam surface layer about 4 inches thick. The subsurface layer, to a depth of about 14 inches, is light brownish gray loam. The subsoil, to a depth of about 65 inches is light brownish gray loam in the upper part and gray silt loam in the lower part.

The moderately well drained, moderately slowly permeable Otanya soils are in the slightly higher positions on the landscape. Reaction is slightly acid grading to very strongly acid. A perched water table is at a depth of 3 to 5 feet during the winter.

Typically, the Otanya soils have a fine sandy loam surface layer about 9 inches thick. It is dark grayish brown in the upper part of the surface layer and very pale brown in the lower part. The subsoil to a depth of about 65 inches is strong brown sandy clay loam.

The poorly drained, slowly permeable Waller soils are in broad, smooth, concave depressions and poorly defined drainageways. Reaction is strongly and very strongly acid throughout. A seasonal high water table is within 2.5 feet of the surface from winter to early summer, and water is on the surface for extended periods.

Typically, the Waller soils have a silt loam surface layer, about 35 inches thick. It is grayish brown in the upper part and gray in the lower part. The subsoil to a depth of about 60 inches is light brownish gray clay loam in the upper part and light brownish gray silty clay loam in the lower part.

Soils of minor extent in this map unit are Dallardsville, Kian, Kirbyville, Pluck, and Splendora soils. Dallardsville soils are on nearly level flats at heads of drainageways. Kian and Pluck soils are on flood plains of streams. Kirbyville and Splendora soils are on lower side slopes.

The soils in this map unit are used mainly as woodland. Water-loving hardwoods, such as water oak and willow oak, do well on these soils. Loblolly pines grow well after establishment, but equipment use, seedling mortality, and plant competition are severe limitations. Drainage systems are required for pastures to produce well.

Because of wetness, the soils in this map unit are poorly suited to most urban and recreation uses.

Moderately well drained to poorly drained, loamy, clayey, sandy, and silty soils; on flood plains

The four general soil map units in this group make up about 11 percent of the survey area. These map units are on flood plains of rivers and creeks. The topography mainly is nearly level. Most areas are in woodland and are used for hardwoods. Some areas are used for loblolly and shortleaf pines, some are in pastures of bahiagrass and bermudagrass, and a few are used as cropland.

10. Hatliff-Pluck-Kian

Nearly level to gently sloping, moderately well drained to poorly drained, moderately rapidly permeable and moderately permeable, loamy soils

This map unit makes up about 4 percent of the survey area. It is about 41 percent Hatliff soils, 32 percent Pluck soils, 17 percent Kian soils, and 10 percent soils of minor extent.

The soils in this map unit are mainly along the principal southerly flowing streams in the survey area. Flood plains are mostly about one-half mile wide. On the flood plains are meandering channels, sloughs, and oxbows. Flooding is frequent. Water-loving hardwood trees and understory are prevalent in these areas. These soils mainly formed in sediment washed from the highly weathered Willis Formation but have sufficient base-saturated sediment from the Fleming Formation that acidity of the soil is reduced.

The moderately well drained, moderately rapidly permeable Hatliff soils are on natural levees along some of the larger streams. Reaction of the various stratified layers ranges from neutral to strongly acid. A seasonal high water table is near the surface during the winter.

Typically, the Hatliff soils have a surface layer about 11 inches thick. It is dark brown loam in the upper part and brown fine sandy loam mottled with gray in the lower part. Below this to a depth of about 80 inches is stratified yellowish brown and very pale brown fine sandy loam, loamy fine sand, and sand.

The poorly drained, moderately permeable Pluck soils are in lower, wetter positions on the flood plains. The surface layer is neutral and the underlying material is mildly alkaline. A seasonal high water table is near the surface during the winter and spring.

Typically, the Pluck soils have a brown fine sandy loam surface layer about 6 inches thick. The underlying material, to a depth of about 52 inches, is stratified grayish brown and light brownish gray fine sandy loam and sandy clay loam. Below that to a depth of about 65 inches is dark gray silty clay loam.

The poorly drained, moderately permeable Kian soils are on natural levees that are only a few inches higher than the Pluck soils. These soils are neutral throughout. A seasonal high water table is near the surface during the winter and spring.

Typically, the Kian soils have a brown fine sandy loam surface layer about 4 inches thick. The subsoil, to a depth of 52 inches, is grayish brown and light brownish gray fine sandy loam. The next layer to a depth of about 65 inches is gray clay loam.

Soils of minor extent in this map unit are Bernaldo, Choates, Kaman, Mantachie, Leggett, Nahatche, Spurger, and Voss soils. Bernaldo, Choates, Leggett, and Spurger soils are on the uplands that are in higher positions on the landscape than the Hatliff and Pluck soils. Kaman soils are dark colored clay. They are in a few places on the flood plains. Also in a few places on the flood plains are the Mantachie and Nahatche soils. Voss soils are on sand ridges and bars that are immediately adjacent to some stream channels.

The soils in this map unit are used mainly as woodland. Water-loving hardwoods, such as water oak, willow oak, cottonwood, and sweetgum, grow well on these soils. Loblolly pines do well on Hatliff soils. Bermudagrass and bahiagrass pastures produce well on Hatliff soils.

These soils are poorly suited to urban and recreation uses because of flooding and wetness. Menard Creek and Big Sandy Creek flow through the Big Thicket National Preserve. These areas provide recreational uses, such as hiking, canoeing, and nature study areas.

11. Kaman-Hatliff-Nahatche

Nearly level to gently sloping, moderately well drained to poorly drained, very slowly permeable, moderately rapidly permeable, and moderately permeable, clayey and loamy soils

This map unit makes up about 4 percent of the survey area. It is about 47 percent Kaman soils, 22 percent Hatliff soils, 14 percent Nahatche soils, and 17 percent soils of minor extent.

The soils in this map unit are on the flood plain of the Trinity River below Lake Livingston. The flood plain is about 1 to 5 miles wide in most places. About half of the area rarely floods because of the protection provided by Lake Livingston. The remaining area floods mainly because of runoff from the tributary streams that enter the Trinity River below Lake Livingston. The Kaman soils formed from upstream clayey cretaceous sediment. The Nahatche and Hatliff soils formed from loamy and sandy sediment from the tributary streams mixed with Trinity River sediment.

The poorly drained, very slowly permeable Kaman soils are in broad, smooth areas. Reaction is slightly acid grading to neutral. A seasonal high water table is within 2.5 feet of the surface during most of the year.

Typically, the Kaman soils have a black clay surface layer about 44 inches thick. The subsoil to a depth of about 72 inches is dark gray clay.

The moderately well drained, moderately rapidly permeable Hatliff soils are on natural levees and in slightly higher areas on the flood plain. Reaction is medium acid throughout. A seasonal high water table is near the surface during the winter.

Typically, the Hatliff soils have a grayish brown loam surface layer about 6 inches thick. The underlying material to a depth of about 55 inches is grayish brown and brown stratified silt loam, fine sandy loam, and very fine sandy loam. Below that to a depth of about 70 inches is a brown loam.

The somewhat poorly drained, moderately permeable Nahatche soils are in broad, smooth areas that are a few inches higher on the landscape than Kaman soils. Reaction is slightly or medium acid grading to strongly acid. A seasonal high water table is near the surface during the winter and spring.

Typically, the Nahatche soils have a dark grayish brown fine sandy loam surface layer about 6 inches thick. The underlying material, to a depth of about 55 inches, is grayish brown stratified loam, very fine sandy loam, and clay loam. Below this layer to a depth of about 72 inches is dark grayish brown clay loam.

Soils of minor extent in this map unit are Bernaldo, Fausse, Spurger, and Voss soils. Bernaldo and Spurger soils are on stream terraces. Fausse soils are in low, ponded, backswamps on the flood plains. Voss soils are on sand ridges and bars.

Most areas that are rarely flooded are in pastures of bermudagrass. A small acreage is in soybeans. Most areas that are frequently flooded are used as woodland. Trees growing on these soils are mainly water oak, willowoak, and sweetgum.

The soils in this map unit are poorly suited to urban and recreation uses because of flooding, wetness, and high shrink-swell potential.

12. Kian-Mantachie

Nearly level to gently sloping, poorly drained and somewhat poorly drained, moderately permeable, sandy and loamy soils

This map unit makes up about 2 percent of the survey area. It is about 35 percent Kian soils, 30 percent Mantachie soils, and 35 percent soils of minor extent.

The soils in this map unit are in the northern part of Polk County, mainly on the flood plain of the easterly flowing Piney Creek and on the flood plains of Piney

Creek tributaries. The flood plains are about one-half mile wide. On the flood plains are meandering channels, sloughs, and oxbows. Flooding is frequent. Water-tolerant hardwood trees are prevalent. These soils formed in sediment washed from the tuffaceous rocks of the Catahoula, Willborn, Manning, and Whitsett Formations. This material has an abundance of sodium salts.

The poorly drained Kian soils are in smooth areas on the flood plains. Reaction is neutral throughout. In places, these soils are slightly saline below a depth of 40 inches. A seasonal high water table is near the surface in winter and spring.

Typically, the Kian soils have a grayish brown loamy fine sand surface layer about 5 inches thick. The underlying material to a depth of about 60 inches is fine sandy loam stratified with loam and loamy fine sand that is dark gray in the upper part and grayish brown in the lower part.

The somewhat poorly drained Mantachie soils are in smooth areas on the flood plains. The soil is very strongly acid throughout. In places, it is slightly saline below a depth of 40 inches. A seasonal high water table is at a depth of 1 foot to 1.5 feet during the winter.

Typically, the Mantachie soils have a surface layer about 13 inches thick. It is dark brown loam in the upper part and grades to brown fine sandy loam in the lower part. The subsoil, to a depth of about 21 inches, is dark grayish brown clay loam. The next layer to a depth of about 60 inches is dark grayish brown loam.

Soils of minor extent in this map unit are Ozias, Pluck, and Pophers soils. These soils are on the flood plains.

The soils in this map unit are mainly used as woodland. Water-tolerant hardwood trees, such as sweetgum and water oak, are most common. A few small areas are in pastures.

The soils in this map unit are poorly suited to urban and recreation uses because of flooding and wetness.

13. Pophers-Ozias

Nearly level, somewhat poorly drained, slowly permeable and very slowly permeable, silty soils

This map unit makes up about 1 percent of the survey area. It is about 65 percent Pophers soils, 25 percent Ozias soils, and 10 percent soils of minor extent.

The soils in this map unit are in the northern part of Polk County on the flood plain of the Neches River. On the flood plains are meandering channels, sloughs, and oxbows. Flooding is frequent. Water-tolerant hardwood trees are prevalent. The soils formed in silty and clayey sediment washed mainly from the Yegua Formation and from members of the Jackson Group. This material has an abundance of sodium salts.

The slowly permeable Pophers soils are in smooth areas on the flood plains. These soils are in slightly higher positions than Ozias soils. Reaction is strongly acid throughout. A seasonal high water table is at a depth of 1 foot to 2 feet during the winter and spring.

Typically, the Pophers soils have a dark brown silty clay loam surface layer about 2 inches thick. The subsoil, to a depth of about 9 inches, is dark yellowish brown silty clay loam. The next layer to a depth of about 60 inches is gray silty clay loam in the upper part and gray clay loam in the lower part.

The very slowly permeable Ozias soils are in smooth areas on the flood plains. These soils are in slightly lower positions than the Pophers soils. Reaction is very strongly acid throughout. A seasonal high water table is at a depth of 1 foot to 2 feet during the winter and spring.

Typically, the Ozias soils have a dark brown silty clay loam about 5 inches thick. The underlying material to a depth of about 60 inches is dark grayish brown silty clay in the upper part and dark grayish brown clay loam in the lower part.

Soils of minor extent in this map unit are Kian and Mantachie soils. These soils are on the flood plains.

The soils in this map unit are used as woodland. Water-tolerant hardwood trees, such as sweetgum, water oak, and willow oak, are most common.

The soils in this map unit are poorly suited to urban and recreation uses because of flooding and wetness.

Somewhat excessively drained to poorly drained, sandy, loamy, and clayey soils; on terraces

The two general soil map units in this group make up about 5 percent of the survey area. These map units are on broad stream terraces. The topography mainly is nearly level to gently undulating. Most areas are in woodland and are used for loblolly and shortleaf pines. Some areas are in pastures of bermudagrass and bahiagrass. A few areas are used as cropland.

14. Bienville-Bernaldo-Spurger

Nearly level to strongly sloping, somewhat excessively drained to moderately well drained, moderately rapidly permeable, moderately permeable, and slowly permeable, sandy and loamy soils

This map unit makes up about 3 percent of the survey area. It is about 49 percent Bienville soils, 21 percent Bernaldo soils, 17 percent Spurger soils, and 13 percent soils of minor extent.

Most of the soils in this map unit are on terraces of the Trinity River. A small area of these soils is on a terrace in the Neches River watershed, and a large area is located at the confluence of Mill Creek, Bear Creek, and Big Sandy Creek on the Alabama and Coushatta Indian Reservation. Slopes range from 0 to 15 percent. The landscape is characterized by broad, nearly level, gently sloping or gently undulating areas and some strongly sloping side slopes. These soils formed in loamy

and sandy sediment of the Beaumont and Deweyville Formations.

The somewhat excessively drained, moderately rapidly permeable Bienville soils are on nearly level to gently sloping or gently undulating ridges. Reaction is slightly acid grading to medium acid. A seasonal high water table is common at a depth of 4 to 6 feet during the winter and spring. These soils are droughty in the summer.

Typically, the Bienville soils have a dark yellowish brown loamy fine sand surface layer about 24 inches thick. The subsoil to a depth of about 80 inches is brown loamy fine sand that has a few bands of a finer textured material.

The well drained, moderately permeable Bernaldo soils are on nearly level to strongly sloping areas. Reaction is slightly acid grading to strongly acid. A seasonal high water table is common at a depth of 4 to 6 feet during the winter.

Typically, the Bernaldo soils have a surface layer about 19 inches thick. It is dark grayish brown fine sandy loam in the upper part and yellowish brown loamy very fine sand in the lower part. The subsoil, to a depth of about 35 inches, is yellowish red and strong brown clay loam. The next layer, to a depth of about 71 inches, is strong brown and reddish yellow loam in the upper part and strong brown loam in the lower part. The substratum is very pale brown sand.

The moderately well drained, slowly permeable Spurger soils are in gently sloping broad areas and on strongly sloping side slopes. The soil is strongly acid grading to very strongly acid. A perched water table is at a depth of 2.5 to 3.5 feet during the winter.

Typically, the Spurger soils have a brown fine sandy loam surface layer about 8 inches thick. The subsoil, to a depth of about 31 inches, is red clay. The next layer, to a depth of about 56 inches, is red clay loam in the upper part and light brownish gray and red sandy clay loam in the lower part. The substratum to a depth of about 72 inches is mottled yellowish red and light brownish gray fine sandy loam.

Soils of minor extent in this map unit are Bonwier, Boykin, Choates, Kian, Kirbyville, Nahatche, Pinetucky, Pluck, Stringtown, and Woodville soils. Bonwier, Boykin, Pinetucky, Stringtown, and Woodville soils are on upland side slopes. Choates and Kirbyville soils are on flats and foot slopes. Kian, Nahatche, and Pluck soils are on the flood plains.

The soils in this map unit are used as pastureland and woodland. Pastures are mainly bermudagrass and bahiagrass. Trees grown on these soils are mainly loblolly, shortleaf, and slash pines. Water oak and sweetgum grow well on the Bernaldo and Spurger soils.

Most soils in this map unit are suited to urban and recreation uses. In places, wetness, sandy surface layers, and slope are limitations to these uses.

15. Garner

Nearly level to gently sloping, poorly drained, very slowly permeable, clayey soils

This map unit makes up about 2 percent of the survey area. It is about 80 percent Garner soils and 20 percent soils of minor extent.

Most of the soils in this map unit are on terraces of the Trinity River. Slopes range from 0 to 5 percent. The landscape is characterized by broad, nearly level to gently sloping areas. These areas were originally tall grass prairies, but a pine and hardwood forest has encroached on most of them. These soils formed in clayey sediment of the Beaumont or Fleming Formations cut and exposed during Beaumont geologic time.

The Garner soils typically have a surface layer of dark gray clay about 5 inches thick. The next layer, to a depth of 65 inches, is gray clay. Reaction is slightly acid in the upper 26 inches and neutral below.

Soils of minor extent are Oakhurst, Spurger, and Woodville soils. These soils are mainly on the steeper side slopes. In some places, they are in the same positions on the landscape as the gently sloping Garner soils.

Most of the nearly level areas are in pastures of bermudagrass. The more sloping areas are in woodland. Trees grown on these soils are mainly loblolly pine, water oak, and sweetgum.

The soils in this map unit are poorly suited to most urban and recreation uses because of the clay texture, shrink-swell potential, and wetness.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Pinetucky fine sandy loam, 1 to 5 percent slopes, is one of several phases in the Pinetucky series.

Some map units are made up of two or more major soils. These map units are called soil complexes, soil associations, or undifferentiated groups.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Diboll-Keltys complex, 1 to 5 percent slopes, is an example.

A *soil association* is made up of two or more geographically associated soils that are shown as one unit on the maps. Because of present or anticipated soil uses in the survey area, it was not considered practical or necessary to map the soils separately. The pattern and relative proportion of the soils are somewhat similar. Stringtown-Bonwier association, strongly sloping, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in a mapped area are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Kian and Mantachie soils, frequently flooded, is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Miscellaneous areas are too small to be shown and are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

BeB—Bernaldo fine sandy loam, 0 to 3 percent slopes. This is a nearly level to gently sloping soil in convex, broad areas that generally are associated with terraces of the Trinity River. Individual areas are elongated to irregular in shape and range from 10 to about 800 acres. The average slope is about 2 percent.

Typically, this soil has a dark grayish brown fine sandy loam surface layer about 4 inches thick. The subsurface layer, to a depth of 19 inches, is very fine sand. The subsoil extends to a depth of 71 inches. The upper part of the subsoil, to a depth of 35 inches, is yellowish red and strong brown clay loam. The next layer, to a depth of 41 inches, is strong brown loam. Below that, to a depth of 57 inches, is reddish yellow loam and light yellowish brown fine sandy loam. The lower part is strong brown loam. The substratum is very pale brown sand to a depth of 80 inches. Reaction is slightly acid in the upper 29 inches, and below that, it is strongly acid.

This soil is well drained. Runoff is slow. The available water capacity is high, and permeability is moderate. A seasonal water table is common at a depth of 4 to 6 feet during the winter. The surface layer is friable and is easily tilled throughout a wide range of moisture content. The root zone is deep and is easily penetrated by plant roots. The erosion hazard is slight.

Included with this soil in mapping are small areas of Bienville, Kirbyville, Nahatche, Kian, Pluck and Spurger soils. Bienville soils are slightly higher positions on the landscape than Bernaldo soil, and Kirbyville and Spurger soils are in lower positions. Nahatche, Kian, and Pluck soils are on small flood plains that drain into a larger flood plain on the Trinity River. Also included are some areas of Bernaldo soils that have a loamy fine sand surface layer and some that have slopes of more than 3 percent. Also included are soils that are similar to Bernaldo soil but are clayey in the upper subsoil. These included soils make up about 35 percent of the map unit.

Most areas of this Bernaldo soil are in pastures of coastal bermudagrass or bahiagrass. The remaining acreage is used as cropland, hayland, or woodland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition. Overgrazing or grazing when the soil is too wet causes surface compaction and poor soil tilth and increases runoff.

This soil is well suited to pine and hardwood trees. There are no special restrictions for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is moderately suited to most urban uses if special design and proper installation procedures are used. The major restrictive features are seasonal wetness and the shrink-swell potential of the soil. This soil has moderate strength and stability to support vehicular traffic, but this can be improved by strengthening or replacing the base material. In winter the water table is a moderate limitation for septic tank absorption fields, but this can be overcome by proper design and by increasing the size of the absorption field.

This soil is well suited to recreational uses.

This Bernaldo soil is in land capability subclass IIe and in woodland ordination group 1o7.

BeC—Bernaldo fine sandy loam, 3 to 8 percent slopes. This is a gently sloping to strongly sloping soil in convex areas that are generally associated with river and stream terraces. Individual areas are elongated to irregular in shape and range from 5 to about 150 acres. The average slope is about 5 percent.

Typically, this soil has a surface layer that is about 15 inches thick. It is brown fine sandy loam in the upper part and light yellowish brown loamy very fine sand in the lower part. The subsoil, to a depth of 33 inches, is reddish brown clay loam. The next layer is light yellowish brown fine sandy loam that grades to a very pale brown sand below a depth of 60 inches. Reaction is slightly acid in the upper part of the profile grading to strongly acid in the lower part.

This soil is well drained. Runoff is slow. The available water capacity is high, and permeability is moderate. The root zone is deep and is easily penetrated by plant roots. A seasonal high water table is common at a depth of 4 to 6 feet during the winter. The soil is easily tilled throughout a wide range of moisture content. The erosion hazard is moderate.

Included with this soil in mapping are small areas of Bienville, Nahatche, Kian, Pluck, and Spurger soils. Bienville soils are slightly higher on the landscape than Bernaldo soil, and Spurger soils are in lower positions. Nahatche, Kian, and Pluck soils are on small flood plains that drain onto the large Trinity River flood plain. Also included are some areas of Bernaldo soils that have slopes that are less than 3 percent or more than 8 percent and some Bernaldo soils that have a loamy fine sand surface layer. Also included are soils that are similar to Bernaldo soil but are clayey in the upper subsoil, and also soils that have a dark surface layer. These included soils make up about 35 percent of the map unit.

Most areas of this Bernaldo soil are in pastures of coastal bermudagrass or bahiagrass. The remaining acreage is used as hayland or woodland.

The use of the soil for pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too wet causes surface compaction and poor soil tilth and increases water runoff.

This soil is well suited to pine and hardwood trees. There are no special restrictions when planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive. Recommended management practices are proper spacing, prescribed burning, and timber stand improvement.

This soil is moderately suited to most urban uses. The major restrictive features are seasonal wetness and the shrink-swell potential of the soil. Septic tank waste disposal will have moderate problems because of seasonal wetness, but this can be overcome by proper design and by increasing the size of the septic tank absorption field. This soil has moderate strength and stability to support vehicular traffic, but this can be improved by strengthening or replacing the base material.

This soil is well suited to most recreational uses. An exception is playgrounds. Slope is a limitation to this use.

This Bernaldo soil is in land capability subclass IVe and in woodland ordination group 1o7.

BfB—Betis loamy fine sand, 1 to 5 percent slopes. This is a gently sloping soil on broad ridgetops and interstream divides. Individual areas are oval to irregular in shape and range from 40 to 2,000 acres. The average slope is about 4 percent.

Typically, this soil has a surface layer that is about 24 inches thick. It is dark grayish brown loamy fine sand to a depth of about 9 inches and yellowish brown and dark yellowish brown loamy fine sand to a depth of 24 inches. The subsoil extends to a depth of 80 inches. It is yellowish red and strong brown loamy fine sand that contains lamellae that grades to fine sand in the lower part of the subsoil. Reaction is very strongly acid in the surface layer and is strongly acid in the subsoil.

This soil is somewhat excessively drained. Runoff is very slow. The available water capacity is low, and permeability is rapid. Excessive moisture loss is common when the soil is tilled. The soil is droughty. The erosion hazard is slight.

Included with this soil in mapping are small areas of Boykin, Choates, Doucette, and Pinetucky soils. Choates soils are in lower positions on the landscape than Betis soil, and Boykin, Doucette, and Pinetucky soils are in similar positions. Also included are some areas of soils that are similar to Betis soil except the loamy fine sand subsoil does not contain lamellae. These included soils make up about 30 percent of the map unit.

Most areas of this Betis soil are used as woodland. The remaining acreage is used as cropland, hayland, or pastureland.

The use of this soil for pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too wet causes surface compaction and poor soil tilth and increases runoff.

This soil is moderately suited to trees. It is best suited to pines. There are severe restrictions when planting trees because of the droughtiness of this soil. Seedling mortality is severe. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive. Recommended management practices are proper spacing, prescribed burning, and timber stand improvement.

This soil is suited to most urban uses if special design and proper installation procedures are used. It does not have sufficient clay and is too permeable to be used for onsite waste disposal. The rapid permeability of this soil is a limitation to use as septic tank absorption fields. The poor filtering capacity of the soil may result in the pollution of ground water. These limitations can be partly overcome by special design and proper installation procedures.

This soil is moderately suited to most recreational uses because of the sandy surface.

This Betis soil is in land capability subclass IIIs and in woodland ordination group 3s2.

BnB—Bienville loamy fine sand, 0 to 3 percent slopes. This is a nearly level to gently sloping soil on ridges and side slopes of convex terraces. Individual areas are irregular in shape and range from 8 to about 2,000 acres. The average slope is about 2 percent.

Typically, this soil has a dark yellowish brown loamy fine sand surface layer about 24 inches thick. The subsoil, to a depth of 80 inches, is brown loamy fine sand that has a few bands of finer material. Reaction is slightly acid to a depth of about 65 inches, and below that, it is medium acid.

This soil is somewhat excessively drained. Runoff is slow, the available water capacity is low, and permeability is moderately rapid. The soil is droughty. The erosion hazard is slight. The root zone is deep and is easily penetrated by plant roots. A seasonal high water table is common at a depth of 4 to 6 feet during the winter and spring.

Included with this soil in mapping are small areas of Bernaldo, Boykin, Choates, Pinetucky, and Woodville soils. Bernaldo and Choates soils are in lower positions on the landscape than Bienville soil. Boykin, Pinetucky, and Woodville soils are in similar positions on the landscape as Bienville soil. These included soils make up about 30 percent of the map unit.

Most areas of this Bienville soil are used as woodland. The remaining acreage is used as cropland, hayland, or pastureland.

The use of the soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep pasture and soil in good condition. Overgrazing or grazing when the soil is too dry causes damage to the vegetation.

This soil is well suited to pine trees. Droughtiness and sandy texture are limitations to use of the soil for planting of trees. Seedling mortality is moderate. If the site is prepared adequately and the competing vegetation is controlled, most seedlings and established stands survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is suited to most urban uses if special design and proper installation procedures are used. Seasonal wetness can limit the use of this soil for disposal of septic tank absorption field effluent, but this limitation can be partially overcome by increasing the size of the absorption field.

This soil is well suited to most recreational uses.

This Bienville soil is in land capability subclass IIs and in woodland ordination group 2s2.

BoB—Boykin loamy fine sand, 1 to 5 percent slopes. This is a gently sloping, well drained soil on upland ridges. Individual areas are irregular in shape and range from 10 to about 300 acres. The average slope is about 2 percent.

Typically, this soil has a surface layer about 22 inches thick. It is grayish brown loamy fine sand in the upper part and grades to brown and pinkish gray loamy fine sand in the lower part. The subsoil, to a depth of 35 inches, is yellowish red fine sandy loam. The next layer to a depth of about 70 inches is red sandy clay loam. Reaction is medium acid in the upper 8 inches, and below that, it is strongly acid.

This soil is well drained. Runoff is slow. The available water capacity is medium, and permeability is moderate. The surface layer is friable and is easily tilled throughout a wide range in moisture content. It does, however, have a tendency to crust or puddle after heavy rains. Plow pans form if the soil is tilled when wet or tilled too often. The root zone is deep and is easily penetrated by plant roots. The erosion hazard is slight.

Included with this soil in mapping are small areas of Betis, Choates, and Doucette soils. Betis soils are in higher positions on the landscape than Boykin soil, Choates soils are in lower positions, and Doucette soils are in similar positions. These included soils make up about 30 percent of the map unit.

Most areas of this Boykin soil are used as woodland. The remaining acreage is used as cropland, hayland, or pastureland.

The use of the soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during periods of drought help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too wet causes surface compaction and poor soil tilth and increases runoff.

This soil is well suited to pine and hardwood trees. There are no special restrictions for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is well suited to most urban uses if special design and proper installation procedures are used. This soil does not have sufficient strength and stability to support vehicular traffic, but this can be improved by strengthening or replacing the base material.

Because of the sandy surface, this soil is moderately suited to most recreational uses.

This Boykin soil is in land capability subclass IIIs and in woodland ordination group 2s2.

BuD—Burkeville clay, 5 to 15 percent slopes. This is a sloping to strongly sloping soil on side slopes of uplands. Individual areas are irregular in shape and range from 3 to about 200 acres. The average slope is about 8 percent.

Typically, this soil has a grayish brown clay surface layer about 5 inches thick. The underlying material to a depth of 60 inches is light brownish gray clay to a depth of about 30 inches, and below that, it is pale olive clay to a depth of about 60 inches. Reaction is moderately alkaline and calcareous throughout.

This soil is somewhat poorly drained. Runoff is medium. The available water capacity is high, and permeability is very slow. A perched water table is near the surface during the winter. The surface layer is very firm and difficult to till. Tillage during pasture planting is difficult because of slopes and wetness. This soil has a severe erosion hazard.

Included with this soil in mapping are small areas of Weirgate, Garner, and Woodville soils. The included soils are in similar positions on the landscape as Burkeville soil. Also included are eroded and gullied areas. These included soils make up about 40 percent of the map unit.

Most areas of this Burkeville soil are used as pastureland. The remaining acreage is in noncommercial woodland. Because of the severe erosion hazard, it is not suited to use as cropland.

The use of the soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, weed control, timely deferment of grazing, and restricted use during wet and dry periods help to keep vegetation and soil in good condition. Overgrazing or grazing when the soil is too dry or too wet causes surface compaction, excessive water runoff, poor soil tilth, and a lower vegetative quality.

This soil is poorly suited to the commercial production of trees because of the clayey, alkaline nature of the soil.

This soil is poorly suited to most urban uses. Wetness, clayey texture, shrink-swell potential, low strength, and slope are the major limitations. This soil does not have sufficient strength and stability to support vehicular traffic. This low strength limitation can be overcome by strengthening or replacing the base material. The shrink-swell potential limitation can be reduced by mixing lime with the soil.

Because of clayey texture, very high shrink-swell potential, and very slow permeability, this soil is poorly suited to rereation uses.

This Burkeville soil is in land capability subclass VIe and in woodland ordination group 5c3.

CaB—Choates loamy fine sand, 1 to 5 percent slopes. This is a gently sloping soil in plane to concave areas on foot slopes. Individual areas are irregular in shape and range from 10 to about 400 acres. The average slope is about 3 percent.

Typically, this soil has a loamy fine sand surface layer about 24 inches thick. It is grayish brown in the upper part of the surface layer, light yellowish brown in the middle part, and very pale brown in the lower part. The subsoil extends to a depth of 80 inches. It is strong brown and reddish yellow sandy clay loam to a depth of 42 inches. The next layers are mottled very pale brown and reddish yellow to a depth of 58 inches. Below that is mottled white and yellow sandy loam. Reaction is medium or strongly acid in the upper 24 inches, and below that, it is very strongly acid.

This soil is somewhat poorly drained. Runoff is slow. The available water capacity is medium, and permeability is moderately slow. The surface layer is loose and is easily tilled throughout a wide range of moisture content. This soil is droughty in the summer and wet in the winter. A seasonal water table is common within 2 feet of the surface during the winter. Roots have difficulty penetrating the soil below a depth of 30 inches. The erosion hazard is slight.

Included with this soil in mapping are small areas of Boykin, Dallardsville, Doucette, Kirbyville, Leggett, Kian, Pinetucky, and Pluck soils. Boykin, Dallardsville, Doucette, and Pinetucky soils are higher on the landscape than Choates soil, Kirbyville and Leggett soils are in similar positions, and Kian and Pluck soils are on small flood plains. Also included are soils that are similar to Choates soil. These soils have a sandy loam surface or a surface layer that is less than 20 inches thick. These included soils make up about 35 percent of this map unit.

Most areas of this soil are in woodland. The remaining acreage is in cropland, hayland, or pastureland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet or dry periods help to keep vegetation and soil in good condition. Overgrazing or grazing when the soil is too wet or too dry causes surface compaction and poor soil tilth, and retards drainage.

This soil is well suited to pine or hardwood trees. Wetness is a moderate limitation for planting or harvesting of trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is poorly suited to most urban uses. Wetness and permeability are the major limitations. When saturated, this soil has moderate limitations for vehicular traffic. The permeability and wetness are limitations for use as septic tank absorption fields, but these limitations can be partially overcome by increasing the size of the absorption field.

Because of wetness, sandy surface layer, and moderately slow permeability, this soil is moderately suited to recreational uses.

This Choates soil is in land capability subclass IIIw and in woodland ordination group 2w8a.

CfB—Colita fine sandy loam, 0 to 3 percent slopes. This is a nearly level to gently sloping soil in upland areas. Individual areas are irregular in shape and range from 20 to about 200 acres. The average slope is about 1 percent.

Typically, this soil has a surface layer that is about 11 inches thick. It is very dark grayish brown fine sandy loam in the upper part of the surface layer and dark grayish brown loamy very fine sand in the lower part. The subsoil, to a depth of 45 inches, is light gray very fine sandy loam and fine sandy loam. About 30 percent of the subsoil is loamy very fine sand interfingers that grade to light gray sandy clay loam. The substratum to a depth of 47 inches is pale olive silty clay loam shale. Reaction is strongly acid or very strongly acid throughout.

This soil is somewhat poorly drained. Runoff is slow. The available water capacity is medium, and permeability is moderate. A perched water table is near the surface during the winter and spring. The surface layer is friable and is easily tilled throughout a wide range of moisture content. This soil has a tendency to form a plow pan if it is tilled when it is too wet or if tilled too often. The erosion hazard is slight.

Included with this soil in mapping are small areas of Diboll, Keltys, Kitterll, Laska, Oakhurst, Rayburn, and Wiergate soils. Diboll soils are in similar positions as the Colita soil. The other included soils are in higher positions on the landscape or are on steeper slopes than Colita soil. Also included are soils that are similar to Colita soil, but they have shale within 40 inches of the surface, are poorly drained, or have sandstone or lignite coal substrata. These included soils make up about 25 percent of the map unit.

Most areas of this soil are in woodland. The remaining acreage is cropland, hayland, or pastureland.

The use of the soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor soil tilth.

This soil is moderately suited to pine and hardwood trees. Seasonal wetness is a moderate limitation for planting or harvesting trees. Before harvesting, the chemical properties of the soil should be evaluated because these properties will affect the success of future reseeding operations. The initial survival rate of tree stands is generally good, but by maturity, these stands have been substantially thinned out by the natural ecology of their environment.

This soil is poorly suited to most urban uses. Wetness is the main limitation. Depth to bedrock is a limitation for

septic tank absorption fields, but this limitation can be overcome by increasing the size of the absorption field or by installing a central sewage system.

Because of wetness, this soil is poorly suited to recreational uses.

This Colita soil is in land capability subclass IIIw and in woodland ordination group 3w8a.

ClB—Colita-Laska complex, 1 to 5 percent slopes. The gently sloping soils in this complex are on uplands. Individual areas are irregular in shape and range from 10 to several thousand acres. The average slope is about 3 percent.

This complex consists of about 40 percent Colita soil and soils that are similar, 35 percent Laska soil and soils that are similar, and 25 percent other soils. Colita soil generally is in flat to slightly concave positions on the landscape, and Laska soil is in slightly convex positions. The soils in this map unit were so intricately mixed that it was not practical to map them separately.

Typically, the Colita soil has a fine sandy loam surface layer about 16 inches thick. It is grayish brown in the upper part and light grayish brown in the lower part. The next layer, to a depth of about 47 inches, is grayish brown very fine sandy loam in the upper part and grades to gray silty clay loam that is mixed with darker very fine sandy loam from the surface layer. The next layer, to a depth of about 50 inches, is gray clay loam that is mixed with very fine sandy loam from the surface layer. The next layer to a depth of 60 inches is light brownish gray siltstone. Reaction is strongly acid or very strongly acid throughout.

The Colita soil is somewhat poorly drained. Runoff is slow. The available water capacity is medium, and permeability is moderate. A perched water table is near the surface during the winter and spring. The surface layer is friable and is easily tilled throughout a wide range in moisture content. This soil has a tendency to form a plow pan if it is tilled when too wet or if tilled too often. The erosion hazard is slight.

Typically, the Laska soil has a fine sandy loam surface layer about 33 inches thick. It is brown in the upper part of the surface layer. The middle part is light yellowish brown and the lower part is light brownish gray. The subsoil to a depth of 63 inches is fine sandy loam. It is grayish brown in the upper part of the subsoil and light gray in the lower part. Reaction is strongly acid or very strongly acid throughout.

The Laska soil is moderately well drained. Runoff is very slow. The available water capacity is medium, and permeability is moderately rapid. This soil is easily tilled. The erosion hazard is moderate. A seasonal water table is about 1.5 to 3 feet below the surface during the winter and spring.

Included with these soils in mapping are small areas of Diboll, Keltys, Kitterll, Oakhurst, and Rayburn soils. Diboll soils are in lower positions on the landscape than the Colita and Laska soils. The other included soils are in higher positions on the landscape or are on steeper slopes. Also included are soils that are similar to Laska soil but have a more clayey subsoil or have parent material within 60 inches of the surface layer; and also soils that are similar to Colita soil but have shale within 40 inches of the surface layer, are poorly drained, or have sandstone substrata. Also included are soils in areas that have lignite substrata. Some areas are eroded.

Most areas of Colita and Laska soils are used as woodland. The remaining acreage is used as cropland, hayland, or pastureland.

The use of these soils for pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the vegetation and soil in good condition. Overgrazing when the soil is too dry or too wet causes damage to vegetation, reduces organic matter, and increases erosion.

These soils are moderately suited to pine and hardwood trees. Seasonal wetness is a moderate limitation for planting or harvesting trees. Before harvesting, the chemical properties of these soils, especially the Colita soil, should be evaluated because these properties will affect the success of future reseeding operations. The initial survival rate of tree stands is generally good, but by maturity, these stands have been substantially thinned out by the natural ecology of their environment.

These soils are poorly suited to most urban uses. Wetness is the main limitation. On the Colita soil, depth to bedrock is a limitation for septic tank absorption fields, but this limitation can be partially overcome by increasing the size of the absorption area or by installing central sewage systems.

Because of wetness, the Colita soil in this map unit is poorly suited to recreational uses. The Laska soil in this map unit is moderately suited to these uses because of wetness.

The soils in this complex are in land capability subclass IIIw. The Colita soil is in woodland ordination group 3w8a and the Laska soil is in woodland ordination group 2w8a.

CpC—Colita Variant-Kitterll complex, 1 to 8 percent slopes. The gently sloping to sloping soils in this complex are on convex ridges. Individual areas are oval or elongated and range from 12 to about 180 acres. The average slope is about 4 percent.

This complex is about 50 percent Colita Variant soils, 20 percent Kitterll soils, 20 percent minor soils, and about 10 percent exposed bedrock or rock outcrops. These soils were so intricately mixed that it was not practical to map them separately.

Typically, the Colita Variant soil has a dark grayish brown fine sandy loam surface layer about 7 inches

thick. The subsurface layer is light brownish gray fine sandy loam to a depth of 11 inches. The subsoil, to a depth of 18 inches, is light brownish gray sandy clay loam. The substratum is light brownish gray weakly consolidated sandstone. Reaction is very strongly acid throughout.

The Colita Variant soil is somewhat poorly drained. Runoff is slow. The available water capacity is low, and permeability is moderate. The erosion hazard is moderate. A perched water table is at a depth of 1 to 2 feet during the winter and spring.

Typically, the Kitterll soil has a grayish brown fine sandy loam surface layer about 10 inches thick. The underlying material is gray weakly cemented sandstone. Reaction is medium acid throughout.

The Kitterll soil is well drained. Runoff is very rapid. The available water capacity is very low, and permeability is moderate. The erosion hazard is severe.

Included in mapping are small areas of Colita, Diboll, Keltys, Laska, and Oakhurst soils. These soils are in lower positions on the landscape or in smoother upland areas than the Colita Variant and Kitterll soils. Also included is a soil that is similar to Colita Variant soil, but it is less than 40 inches to bedrock and has a sandier subsoil. Also included are areas of soils that are more sloping or have up to 25 percent exposed bedrock or rock fragments.

Most areas of this complex are in woodland. The remaining acreage is in pastureland. These soils are not suited to use as cropland or hayland because of the shallow depth to bedrock and the rock fragments on the surface.

The soils in this map unit should be carefully protected from erosion when used as pastureland because of the shallowness of the soils. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soils in good condition. Overgrazing or grazing when these soils are too wet causes surface compaction and poor soil tilth and increases runoff.

The soils in this map unit are poorly suited to commercial tree production because of the shallow root depth. This complex is dominated by trees that have a normal growth rate until they reach 30 to 35 years of age. At this time, the growth rate slows or stops, and tree mortality may occur. Tree harvest rotation on these soils should coincide with the cessation of growth.

These soils are poorly suited to most urban and engineering uses because of shallow depth and slope. The rocklike material is moderately well suited to use for roadfill.

The soils in this map unit are poorly suited to recreational uses because of wetness and depth to bedrock.

The soils in this complex are in capability subclass VIs and in woodland ordination group 5d3.

CrB—Conroe gravelly loamy fine sand, 1 to 5 percent slopes. This is a gently sloping soil on upland plains or interstream convex divides. Individual areas are irregular in shape and range from 50 to several thousand acres. The average slope is about 3 percent.

Typically, this soil has a gravelly loamy fine sand surface layer about 22 inches thick. It is dark gray in the upper part and light yellowish brown in the lower part. The subsoil, to a depth of 60 inches, is yellowish brown sandy clay loam and sandy clay in the upper part and mottled light gray, light brownish gray, and brownish yellow sandy clay in the lower part. Reaction is very strongly acid throughout.

This soil is moderately well drained. Runoff is slow. The available water capacity is medium, and permeability is slow. A perched water table is at a depth of 2 to 3.5 feet during the winter and spring. The surface layer is very friable and is easily tilled throughout a wide range of moisture content. This soil is droughty during the summer. Roots have difficulty penetrating the soil below a depth of 26 inches. The erosion hazard is slight.

Included with this soil in mapping are small areas of Betis, Boykin, and Pinetucky soils that are all similar positions on the landscape as Conroe soils. Also included are some areas of Conroe soils that do not have a gravelly surface layer, have a surface layer that is less than 20 inches thick, or have a subsoil that is less clayey. Soil inclusions have slopes greater than 5 percent. These included soils make up about 20 percent of this map unit.

Most areas of this Conroe soil are used as woodland. A few areas are mined for the surface gravel. The remaining acreage is used as cropland, hayland, or pastureland.

The use of the soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too wet causes surface compaction and poor soil tilth and increases runoff.

This soil is moderately suited to pine trees. The clayey subsoil and the sandy surface are moderate limitations for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is moderately suited to most urban uses. Seasonal wetness and slow permeability are the main limitations, but these limitations can be overcome if special design and proper installation procedures are used.

Because of the gravelly surface layer, this soil is poorly suited to most recreational uses.

This Conroe soil is in land capability subclass IIIs and in woodland ordination group 3s2.

CrC—Conroe gravelly loamy fine sand, 5 to 8 percent slopes. This is a sloping soil on rolling upland side slopes. Individual areas are elongated and range from 20 to about 200 acres. The average slope is about 6 percent.

Typically, this soil has a gravelly loamy fine sand surface layer about 22 inches thick. It is light gray in the upper part of the surface layer and light yellowish brown in the lower part. The subsoil, to a depth of 60 inches, is yellowish brown sandy clay loam and sandy clay in the upper part and is prominently mottled reddish brown, strong brown, red and yellow sandy clay in the lower part. Reaction is very strongly acid throughout.

This soil is moderately well drained. Runoff is slow. The available water capacity is medium, and permeability is slow. A perched water table is at a depth of 2 to 3.5 feet during the winter and spring. Roots have difficulty penetrating the soil below a depth of 26 inches. This soil is droughty during the summer. The erosion hazard is severe.

Included with this soil in mapping are small areas of Pinetucky soils that are in similar positions on the landscape as Conroe soil. Also included are soils that are similar to Conroe soil but have a surface layer that is less than 20 inches thick, do not have a gravelly surface layer but have a loamy surface layer, or have a subsoil that is less clayey than Conroe soil. In some areas, the soils have slopes of less than 5 percent. Also included are eroded areas. These included soils make up about 30 percent of the map unit.

Most areas of this Conroe soil are used as woodland. A few areas are mined for the surface gravel. The remaining acreage is used as hayland and pastureland. This soil is not suited to cropland because of the severe erosion hazard.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too wet causes surface compaction and poor soil tilth and increases runoff.

This soil is moderately suited to pine trees. The clayey subsoil and sandy surface layer are moderate limitations for planting or harvesting trees. If the site is prepared adequately and competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is moderately suited to most urban uses. Seasonal wetness and slope are the major limitations. These limitations may be overcome if special design and proper installation procedures are used. Slow permeability is a severe limitation, but this limitation can be partially overcome by increasing the size of the absorption field.

Because of the gravelly surface layer of this soil, it is poorly suited to most recreational uses.

This Conroe soil is in land capability subclass VIe and in woodland ordination group 3s2.

DaA—Dallardsville loamy very fine sand, 0 to 2 percent slopes. This is a nearly level to gently sloping soil near the head of flat, poorly defined drainageways and on nearly level flats that typically are interspersed with low mounds and ridges. Individual areas are irregular in shape and range from 15 to about 300 acres. The average slope is about 0.5 percent.

Typically, this soil has a loamy very fine sand surface layer about 19 inches thick. It is grayish brown in the upper part of the surface layer, pale brown in the middle part, and very pale brown in the lower part. The subsoil, to a depth of 70 inches, is light gray loamy very fine sand tongued and mixed with pale brown very fine sandy loam in the upper part that grades to light gray clay loam. Reaction is very strongly acid or extremely acid throughout.

This soil is somewhat poorly drained. Runoff is medium. The available water capacity is high, and permeability is moderately slow. A perched water table is at a depth of 1 to 2 feet during the winter and spring. The surface layer is very friable and is easily tilled throughout a wide range in moisture content. The root zone is deep and is easily penetrated by plant roots. The erosion hazard is slight.

Included with this soil in mapping are small areas of Choates, Kirbyville, Sorter, Splendora, and Waller soils. Choates, Kirbyville, and Splendora soils are in higher positions on the landscape than Dallardsville soil, and Sorter and Waller soils are in lower positions. Also included are soils that are similar to Dallardsville soil. They have a thick topsoil with a sandy clay loam subsoil. These soils are on the low mounds and ridges. These included soils make up about 40 percent of the map unit.

Most areas of this Dallardsville soil are used as woodland. The remaining acreage is used as cropland, hayland, or pastureland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, weed control, timely deferment of grazing, and restricted use during wet periods help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too wet causes surface compaction and poor soil tilth.

This soil is moderately suited to pine trees and water-tolerant hardwoods. Seasonal wetness is a moderate limitation for planting or harvesting trees. If the site is prepared adequately and competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is moderately suited to most urban uses. Soil wetness is the major limitation. The moderately slow permeability of this soil is a limitation to use as septic tank absorption fields, but this limitation can be partly overcome by increasing the size of the absorption field.

Because of wetness, this soil is poorly suited to most recreational uses.

This Dallardsville soil is in land capability subclass IIw and in woodland ordination group 2w8a.

DbB—Diboll silt loam, 0 to 3 percent slopes. This is a nearly level to gently sloping soil on upland flats and in slight depressions. Individual areas are irregular in shape and range from 20 to about 200 acres. The slope is about 0.8 percent.

Typically, this soil has a grayish brown and dark grayish brown silt loam surface layer about 5 inches thick. The subsurface layer is light brownish gray, very fine sandy loam to 22 inches. The subsurface layer is light brownish gray very fine sandy loam to a depth of 22 inches. The subsoil, to a depth of 39 inches, is grayish brown silt loam that has streaks of very fine sandy loam. The next layer to a depth of 45 inches is light yellowish brown clay loam. The substratum is light yellowish brown siltstone. Reaction is very strongly acid throughout.

This soil is somewhat poorly drained. Runoff is slow. The available water capacity is medium, and permeability is very slow. A perched water table is near the surface during the winter and spring. The surface layer is friable and is easily tilled throughout a wide range in moisture content. This soil has a tendency to form a plow pan if it is tilled when too wet or if tilled too often. The erosion hazard is slight.

Included with this soil in mapping are small areas of Colita, Keltys, Laska, and Oakhurst soils. With the exception of Oakhurst soils, the other included soils are higher on the landscape than Diboll soil. Also included are soils that are similar to Diboll soil. These soils are more than 50 inches deep or are poorly drained, or have sandstone or lignite coal substrata. These included soils make up about 25 percent of the map unit.

Most areas of this Diboll soil are in woodland. The remaining acreage is in cropland, hayland, or pastureland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition. Overgrazing or grazing when the soil is too wet causes surface compaction, poor soil tilth, and excessive runoff.

This soil is well suited to pine and hardwood trees. Seasonal wetness is a moderate limitation for planting or harvesting trees. Before harvesting, the chemical properties of the soil should be evaluated because these properties will affect the success of future reseeding operations. High seedling mortality can occur on this soil for several years following planting.

This soil is poorly suited to most urban uses. Wetness is the main limitation. Depth to bedrock is a limitation for septic tank absorption fields, but this can be overcome by increasing the size of the absorption area or by installing a central sewage system.

This soil is poorly suited to recreational uses because of wetness, very slow permeability, and excess sodium.

This Diboll soil is in land capability subclass IIIe and in woodland ordination group 3w9.

DkB—Diboll-Keltys complex, 1 to 5 percent slopes. The gently sloping soils in this complex are on uplands. Individual areas are irregular in shape and range from 10 to several hundred acres. The average slope is about 2 percent.

This complex consists of about 40 percent Diboll soil, 35 percent Keltys soil, and 25 percent other soils. The Diboll soil is in flat to slightly concave positions on the landscape. The Keltys soil is in slightly convex positions. The soils in this map unit were so intricately mixed that it was not practical to map them separately.

Typically, the Diboll soil has a very fine sandy loam surface layer about 20 inches thick. It is mottled grayish brown and dark grayish brown in the upper part and light brownish gray in the lower part. The next layer, to a depth of about 36 inches, is grayish brown loam and very fine sandy loam that is mixed with light brownish gray material from the horizon above. The next layer to a depth of 60 inches is light yellowish brown weakly consolidated siltstone. Reaction is very strongly acid throughout.

The Diboll soil is somewhat poorly drained. Runoff is slow. The available water capacity is medium, and permeability is very slow. A perched water table is near the surface during the winter and spring. The surface layer is friable and is easily tilled throughout a wide range of moisture content. This soil has a tendency to form a plow pan if it is tilled when too wet or if tilled too often. The erosion hazard is slight.

Typically, the Keltys soil has a very fine sandy loam surface layer about 29 inches thick. It is brown in the upper part and pale brown in the lower part. The next layer, to a depth of about 34 inches, is grayish brown fine sandy loam that is mixed with pale brown very fine sandy loam material from the horizon above. The next layer, to a depth of about 48 inches, is sandy clay loam that is grayish brown in the upper part and yellowish brown in the lower part and is mixed with pale brown very fine sandy loam material from the horizon above. The next layer, to a depth of about 55 inches, is gray sandy clay loam that is mixed with light yellowish brown very fine sandy loam material from the horizon above. Below that is platy siltstone. Reaction is strongly acid throughout.

The Keltys soil is moderately well drained. Runoff is slow. The available water capacity is medium, and permeability is slow. The erosion hazard is slight. A perched water table is at a depth of 2.5 to 3.5 feet during the winter and spring.

Included with these soils in mapping are small areas of Colita, Herty, Laska, Moswell, Oakhurst, and Rayburn soils. Colita, Herty, and Oakhurst soils are in similar positions on the landscape as Diboll soil. Laska, Moswell, and Rayburn soils are in similar positions on the landscape as Keltys soils. Also included is a soil that is similar to Diboll soil but has a solum that is deeper than 50 inches or is poorly drained; and also a soil that is similar to Keltys soil that has a sandier subsoil or is deeper than 60 inches. Also included are a few areas of soils that have lignite coal in the substratum.

Most areas of these Diboll and Keltys soils are used as woodland. The remaining acreage is used as cropland, pastureland, or hayland.

The use of these soils as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry or wet periods help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too wet or too dry causes damage to vegetation, reduces organic matter, and increases erosion.

Diboll soil is well suited to pine and hardwood trees, and Keltys soil is well suited to trees, especially to pine trees. Seasonal wetness is a moderate limitation to use of Diboll soil for planting or harvesting trees. Before harvesting, the chemical properties of the soils in this map unit should be evaluated because these properties will affect the success of future reseeding operations. This is especially true of the Diboll soil because a high seedling mortality can occur on this soil for several years after planting.

The soils in this map unit are poorly suited to most urban uses. Wetness is the main limitation. Depth to bedrock is a limitation to use of Diboll soil as septic tank absorption fields, but this limitation can be overcome by increasing the size of the absorption fields or by installing a central sewage system.

Because of wetness, very slow permeability, and excess sodium, Diboll soil is poorly suited to recreational uses. Keltys soil is only moderately suited to recreational uses because of slow permeability.

Figure 2.—Harvesting timber on Doucette loamy fine sand, 1 to 5 percent slopes. These logs can be used for lumber or processed for pulp.

Figure 3.—This pit-type livestock pond on Garner clay, 0 to 1 percent slopes, is used to help distribute grazing.

The soils in this complex are in land capability subclass IIIe. The Diboll soil is in woodland group 3w9 and the Keltys soil is in woodland ordination group 2o7.

DoB—Doucette loamy fine sand, 1 to 5 percent slopes. This is a gently sloping soil on upland ridges. Individual areas are irregularly shaped and range from 10 to about 2,000 acres. The average slope is about 2 percent.

Typically, this soil has a loamy fine sand surface layer about 22 inches thick. It is dark grayish brown in the upper part and grades to pale brown in the lower part. The subsoil, to a depth of 70 inches, is sandy clay loam. It is strong brown in the upper part and grades to mottled strong brown, yellowish red, and light brownish gray in the lower part. Reaction is medium acid in the upper part of the surface layer grading to very strongly acid in the lower part. It is very strongly acid throughout the subsoil.

This soil is well drained. Runoff is slow. The available water capacity is medium, and permeability is moderate. The surface layer is friable and is easily tilled throughout a fairly wide range in moisture content. The erosion hazard is slight.

Included with this soil in mapping are small areas of Boykin, Choates, Pinetucky, and Woodville soils. Boykin and Pinetucky soils are in similar positions on the landscape as Doucette soil, Choates soils are in lower positions, and Woodville soils are along slope breaks. These included soils make up about 30 percent of the map unit.

Most areas of this Doucette soil are used as woodland. The remaining acreage is used as cropland, hayland, or pastureland.

The use of the soil for pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the vegetation and soil in

good condition. Overgrazing or grazing when the soil is too wet or too dry causes surface compaction, reduces organic matter, and increases weed competition.

The soil is well suited to pine trees (fig. 2). Sandy texture is a moderate limitation for planting trees. If the site is prepared adequately and competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is well suited to most urban uses if special design and proper installation procedures are used.

This soil is well suited to most recreational uses.

This Doucette soil is in land capability subclass IIIs and in woodland ordination group 2s2.

Fa—Fausse clay, frequently flooded. This soil is in low, ponded backswamp areas of the Trinity River. Individual areas are irregularly shaped and range from 15 to 150 acres. Slopes are less than 1 percent.

This soil has a very dark grayish brown mucky organic surface about 1 inch thick. The next layer to a depth of 8 inches is medium acid, very dark grayish brown clay. The subsoil to a depth of 42 inches is neutral, dark gray clay. The substratum to a depth of 60 inches is gray clay. Reaction ranges from strongly acid to neutral.

This soil is very poorly drained. Permeability is very slow. This soil remains ponded for long periods after it has been flooded. The erosion hazard is slight.

Included with this soil in mapping are small areas of Kaman soils. Kaman soils are in higher positions on the landscape than Fausse soil. Included soils make up less than 10 percent of the map unit.

This soil mainly is used for wood production and for habitat for wildlife. Baldcypress and water tupelo, and red maple are the dominant trees. The trees recommended for planting are green ash and baldcypress. Use of equipment on this soil has severe limitations because of wetness.

This soil is not suited to urban use. The main limitations are wetness, low strength, clay content, shrink-swell potential, and flooding. Flooding is difficult to overcome.

This soil is poorly suited to recreational uses because of flooding, wetness, and clayey texture.

This Fausse soil is in land capability subclass VIIw and in woodland ordination group 4w6.

GaA—Garner clay, 0 to 1 percent slopes. This is a nearly level soil on terraces and upland plains. Individual areas are irregular in shape and range from 5 to several thousand acres. The average slope is about 0.3 percent.

Typically, this soil has a dark gray clay surface layer about 5 inches thick. The subsoil to a depth of 65 inches is gray clay. Reaction is slightly acid in the surface layer and upper 21 inches of the subsoil and neutral in the lower part of the subsoil.

This soil is poorly drained. Runoff is slow. The available water capacity is high, and permeability is very slow. The surface layer is firm, slow to dry, and difficult to till throughout a narrow range of moisture content. The erosion hazard is slight.

Included with this soil in mapping are small areas of Oakhurst, Spurger, and Woodville soils. Oakhurst soils are in similar positions on the landscape as Garner soil. Spurger and Woodville soils are along slope breaks. Also included are soils that are similar to Garner soil but have a thin loamy surface, or are more brown in color, or have over 60 percent clay in the solum. These included soils make up about 45 percent of the map unit.

Most areas of this Garner soil are pastureland (fig. 3 and fig. 4). The remaining acreage is used as hayland, woodland, or cropland.

The use of the soil for pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, installation of drains, and restricted use during wet periods help to keep the pasture and soil in good condition. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive water runoff, and poor soil tilth.

This soil is moderately suited to pines or water-tolerant hardwood trees. When this clayey soil is saturated, there are severe limitations to use of equipment when planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing and timber stand improvement.

This soil is poorly suited to most urban uses. Wetness, shrink-swell potential, clayey texture, and low strength are the main limitations. Structures should be designed to withstand the high shrink-swell potential. When saturated, this soil does not have strength and stability to support vehicular traffic, but this low soil strength limitation can be partially overcome by strengthening or replacing the base material. Very slow permeability is a limitation to use as septic tank absorption fields; therefore, installation of central sewage treatment plants is recommended.

Because of wetness, clayey texture, and very slow permeability, this soil is poorly suited to recreational uses.

This Garner soil is in land capability subclass IIIw and in woodland ordination group 3w8b.

GaB—Garner clay, 1 to 5 percent slopes. This is a gently sloping soil on the side slopes of upland plains. Individual areas are elongated and range from 10 to about 800 acres. The average slope is about 3 percent.

Typically, this soil has a very dark gray clay surface layer about 3 inches thick. The subsoil extends to a depth of 65 inches. It is light gray clay in the upper part and gray in the lower part. Reaction is slightly acid in the upper part of the profile and neutral in the lower part.

This soil is poorly drained. Runoff is medium. The available water capacity is high, and permeability is very slow. The surface layer is firm, slow to dry, and difficult to till. The erosion hazard is severe.

Included with this soil in mapping are small areas of Spurger and Woodville soils. These soils are along slope breaks. Also included is a soil that is similar to Garner soil but is more brown. These included soils make up about 45 percent of the map unit.

Most areas of this Garner soil are used as woodland. The remaining acreage is used as cropland, hayland, and pastureland.

The use of the soil for pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive water runoff, and poor soil tilth.

This soil is moderately suited to pines or water-tolerant hardwood trees. When this clayey soil is saturated, there are severe limitations to use of equipment when planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, and timber stand improvement.

This soil is poorly suited to most urban uses. Wetness, shrink-swell potential, clayey texture, and low strength are the main limitations. Structures should be designed to withstand the high shrink-swell potential. When saturated, this soil does not have strength and stability to support vehicular traffic, but this low strength limitation can be partially overcome by strengthening or replacing the base material. Very slow permeability is a limitation to use as septic tank absorption fields; therefore, installation of central sewage treatment plants is recommended.

Because of wetness, clayey texture, and very slow permeability, this soil is poorly suited to recreational uses.

This Garner soil is in land capability subclass IVe and in woodland ordination group 3w8b.

Ha—Hatliff loam, rarely flooded. This is a nearly level to gently sloping soil on high flood plains of major

Figure 4.—A pasture of bermudagrass on Garner clay, 0 to 1 percent slopes.

drainageways. Individual areas are elongated and range from 20 to about 120 acres. The average slope is about 0.7 percent.

Typically, this soil has a grayish brown loam surface layer about 6 inches thick. The underlying material, to a depth of 55 inches, is grayish brown and brown stratified silt loam, fine sandy loam, and very fine sandy loam. Below that to a depth of about 70 inches is brown loam. Reaction is medium acid throughout.

This soil is moderately well drained. Runoff is slow. The available water capacity is medium, and permeability is moderately rapid. Most of these areas have no record of overflow and are protected from flooding by Lake Livingston. A seasonal high water table is near the surface during the winter. The surface layer is friable and is easily tilled throughout a wide range of moisture content. The root zone is deep and is easily penetrated by plant roots. The erosion hazard is slight.

Included with this soil in mapping are small areas of Kian, Nahatche, Pluck, Spurger, and Voss soils. Kian, Nahatche, and Pluck soils are on the flood plains. Spurger soils are on terrace slopes along the flood plains. These included soils make up about 30 percent of the map unit.

Most areas of this Hatliff soil are mainly used as pastureland. Some areas are used as cropland. Soybeans have recently been introduced and production is satisfactory.

This soil is well suited to pine and hardwood trees. Wetness and flooding are moderate limitations for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is moderately suited to most urban uses if special design and proper installation procedures are used. Wetness is the main limitation. Saturation of the soil during the winter is a limitation to use as septic tank absorption fields, but this limitation can be partially overcome by artificial drainage and by increasing the size of the absorption field.

This soil is poorly suited to most recreational uses because of wetness.

This Hatliff soil is in land capability subclass IIw and in woodland ordination group 2w8b.

Hf—Hatliff loam, frequently flooded. This is a nearly level to gently sloping soil on low flood plains of major drainageways. Individual areas are elongated and range from 12 to about 600 acres. The average slope is about 0.7 percent.

Typically, this soil has a surface layer about 11 inches thick. It is dark brown loam in the upper 5 inches, and below that, it is brown fine sandy loam mottled with gray. The underlying material to a depth of 80 inches is stratified yellowish brown and very pale brown, fine sandy loam, loamy fine sand, and sand. Reaction of the various stratified layers ranges from neutral to strongly acid.

This soil is moderately well drained. Runoff is slow. The available water capacity is medium, and permeability is moderately rapid. A seasonal high water table is near the surface during the winter. The surface layer is friable and is easily tilled for pasture planting throughout a wide range of moisture content. The erosion hazard is slight.

Included with this soil in mapping are small areas of Kaman, Kian, Nahatche, Pluck, and Voss soils. The included soils are on the flood plains. Also included are soils in areas that are only occasionally flooded, and also some soils that are similar to Hatliff soil, but they have a grayer lower layer. These included soils make up about 40 percent of the map unit.

Most areas of this Hatliff soil are used as pastureland and woodland. The remaining acreage is used as hayland. This soil is not suited to cropland because of the flooding frequency.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use when the soil is flooded or during other periods of wetness or dryness help to keep the pasture and soil in good condition. Overgrazing or grazing when the soil is too wet reduces protection of the soil when it is flooded and causes surface compaction and poor soil tilth.

This soil is well suited to hardwood trees. Wetness is a moderate limitation for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is poorly suited to most urban and recreation uses because of flooding. The flooding limitation is difficult and costly to overcome.

This Hatliff soil is in land capability subclass Vw and in woodland ordination group 2w8b.

HrB—Herty silt loam, 1 to 3 percent slopes. This is a gently sloping soil on uplands. Individual areas are irregular in shape and range from 10 to several hundred acres. The average slope is about 2 percent.

Typically, this soil has a dark brown silt loam surface layer about 2 inches thick. The subsoil, to a depth of about 46 inches, is silty clay. It is dark grayish brown in the upper 39 inches of the subsoil, and below that, it is dark yellowish brown. The substratum to a depth of about 60 inches is dark grayish brown clayey shale. Reaction is very strongly acid in the surface layer, and below that, it is extremely acid.

This soil is somewhat poorly drained. Runoff is slow. The available water capacity is high, and permeability is very slow. A perched water table is near the surface during the winter. The surface layer is friable and

provides a suitable seedbed, but root development is restricted by the subsoil. The erosion hazard is moderate.

Included with this soil in mapping are small areas of Diboll, Keltys, and Moswell soils. Diboll soils are in similar positions on the landscape as Herty soil, Keltys and Moswell soils are in higher positions. Also included are some areas of Herty soils that are more sloping, soils that are similar to Herty soil but have a less clayey subsoil, and some soils on eroded areas. These included soils make up about 30 percent of the map unit.

Most areas of this Herty soil are used as woodland. The remaining acreage is used as cropland, hayland, or pastureland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too wet causes compaction and poor soil tilth and increases runoff.

This soil is moderately suited to pine and hardwood trees. Wetness and the high clay content of the subsoil are moderate limitations for planting or harvesting trees. Before harvesting, the chemical properties of this soil should be evaluated because these properties will affect the success of future reseeding operations.

This soil is poorly suited to most urban uses. High shrink-swell potential, low strength, wetness, and very slow permeability are the main limitations. When saturated, this soil does not have sufficient strength and stability to support vehicular traffic, but this limitation can be corrected by strengthening or replacing the base material. The very slow permeability of the soil is a limitation to use as septic tank absorption fields, but this limitation can be overcome by installing central sewage treatment plants.

Wetness and permeability are limitations to use of this soil for recreational uses.

This Herty soil is in capability subclass IIIe and in woodland ordination group 3c8.

HrC—Herty silt loam, 3 to 5 percent slopes. This is a gently sloping soil on uplands. Individual areas are irregular in shape and range from 10 to several hundred acres. The average slope is about 4 percent.

Typically, this soil has a dark grayish brown silt loam surface layer about 7 inches thick. The subsoil, to a depth of about 36 inches, is dark grayish brown clay. The next layer, to a depth of 48 inches, is mottled dark grayish brown and brown clay that contains mudstone fragments. The substratum to a depth of 60 inches is dark brown mudstone. Reaction is extremely acid throughout.

This soil is somewhat poorly drained. Runoff is medium. The available water capacity is high, and permeability is very slow. A perched water table is near the surface during the winter. The surface layer is friable and provides a suitable seedbed, but root development is restricted by the subsoil. The erosion hazard is severe.

Included with this soil in mapping are small areas of Diboll, Keltys, and Moswell soils. Diboll soils are in lower positions on the landscape than Herty soil, and Keltys and Moswell soils are in higher positions. Also included are areas of Herty soils that are more sloping and areas of soils that are similar to Herty soil but have a less clayey subsoil. Also included are some soils that are in eroded areas and some soils in areas that have rock fragments on the soil surface. These included soils make up about 30 percent of the map unit.

Most areas of this Herty soil are used as woodland. The remaining acreage is used as cropland, hayland, or pastureland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too wet causes compaction and poor soil tilth and increases runoff.

This soil is moderately suited to pine and hardwood trees. Wetness and the high clay content of the subsoil are moderate limitations for planting or harvesting trees. Before harvesting, the chemical properties of this soil should be evaluated because these properties will affect the success of future reseeding operations.

This soil is poorly suited to most urban uses. High shrink-swell potential, low strength, wetness, and very slow permeability are the main limitations. When saturated, this soil does not have sufficient strength and stability to support vehicular traffic, but this limitation can be corrected by strengthening or replacing the base material. The very slow permeability of the soil is a limitation to use as septic tank absorption fields, but this limitation can be overcome by installing central sewage treatment plants.

Wetness and permeability are limitations to use of this soil for recreational uses.

This Herty soil is in land capability subclass IVe and in woodland ordination group 3c8.

Ka—Kaman clay, rarely flooded. This is a nearly level soil on the flood plains of the Trinity River, which is protected from flooding by Lake Livingston. Individual areas are elongated to irregular in shape and range from 20 to about 600 acres. The average slope is about 0.2 percent.

Typically, this soil has a black clay surface layer about 44 inches thick. The next layer to a depth of about 72 inches is dark gray clay. Reaction is slightly acid grading to neutral.

This soil is poorly drained. Runoff is very slow. The available water capacity is high, and permeability is very slow. A water table is within 2.5 feet of the surface most

of the year. The surface layer is firm and is difficult to till. It has a tendency to crust or puddle after heavy rains. The erosion hazard is slight.

Included with this soil in mapping are small areas of Bernaldo, Hatliff, Kian, Nahatche, Pluck, Spurger, and Voss soils. Bernaldo and Spurger soils are along the terrace side slopes. Hatliff, Kian, Nahatche, Pluck, and Voss soils are on the flood plains. Also included are some areas of Kaman soils that are flooded more often than the Kaman clay soil. The included soils make up about 25 percent of the map unit.

Most areas of this Kaman soil are used as pastureland. The remaining acreage is used as cropland, woodland, and hayland.

The use of the soil for pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet and dry periods help to keep the pasture and soil in good condition. Overgrazing or grazing when the soil is too wet causes surface compaction and poor soil tilth.

This soil is well suited to water-tolerant hardwood trees. Wetness during the winter months is a severe limitation for planting or harvesting trees. If the site is prepared adequately and the vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing and timber stand improvement.

This soil is poorly suited to most urban uses. Wetness, clayey texture, very slow permeability, and shrink-swell potential are main limitations. This soil does not have sufficient strength and stability to support vehicular traffic and has a high shrink-swell potential. Low strength and shrink-swell potential are severe limitations for local roads and streets.

Because of wetness, clayey texture, and very slow permeability, this soil is poorly suited to most recreational uses.

This Kaman soil is in land capability subclass IIw and in woodland ordination group 1w6a.

Kf—Kaman clay, frequently flooded. This is a nearly level soil on the low flood plain of the Trinity River and on the flood plains of a few streams. Individual areas are elongated to irregular in shape and range from 20 to about 400 acres. The average slope is 0.4 percent.

Typically, this soil has a black clay surface layer about 40 inches thick. The subsoil to a depth of about 72 inches is dark gray clay. Reaction is slightly acid in the surface layer and is medium acid in the upper part of the subsoil and mildly alkaline in the lower part.

This soil is poorly drained. Runoff is very slow. The available water capacity is high, and permeability is very slow. A water table is within 2.5 feet of the surface most of the year. The surface layer is firm and is difficult to till for pasture planting. The erosion hazard is slight.

Included with this soil in mapping are small areas of Bernaldo, Hatliff, Kian, Nahatche, Pluck, Spurger, and Voss soils. Bernaldo and Spurger soils are on terrace side slopes. Hatliff, Kian, Nahatche, Pluck, and Voss soils are on the flood plains. Also included are areas of Kaman soils that flood less, and also soils that are similar to Kaman soil but are loamy in some parts. These included soils make up about 30 percent of the map unit.

Most areas of this Kaman soil are used as pastureland. The remaining acreage is used as woodland or hayland. This soil is poorly suited to cropland because it is frequently flooded.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet, or flooded, or dry periods help to keep the pasture and soil in good condition. Overgrazing or grazing when the soil is too wet causes surface compaction and poor soil tilth.

This soil is well suited to water-tolerant hardwood trees. Wetness and flooding are severe limitations for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow very well. Recommended management practices include proper spacing and timber stand improvement.

This soil is not suited to most urban uses. Wetness, flooding, clayey texture, very slow permeability, and shrink-swell potential are the main limitations. Flooding is difficult and costly to overcome.

Because of flooding, wetness, clayey texture, and very slow permeability, this soil is poorly suited to recreational uses.

This Kaman soil is in land capability subclass Vw and in woodland ordination group 1w6a.

KlB—Keltys very fine sandy loam, 1 to 5 percent slopes. This is a gently sloping soil on ridges of uplands. Individual areas are oval and irregular in shape and range from 10 to several hundred acres. The average slope is about 3 percent.

Typically, this soil has a very fine sandy loam surface layer about 29 inches thick. It is dark brown in the upper part and pale brown in the lower part. The subsoil is grayish brown fine sandy loam to a depth of about 34 inches, and it is grayish brown, yellowish brown, and gray sandy clay loam to a depth of 55 inches. The subsoil is mixed with about 30 percent gray or brown very fine sandy loam. The substratum to a depth of 65 inches is siltstone. Reaction is strongly acid in the upper 5 inches of the surface layer and medium acid to a depth of 29 inches. It is strongly acid in the subsoil.

This soil is moderately well drained. Runoff is slow. The available water capacity is medium, and permeability is slow. The erosion hazard is moderate. A perched water table is at a depth of 2.5 to 3.5 feet during the winter.

Included with this soil in mapping are small areas of Colita, Diboll, Laska, and Oakhurst soils. Colita, Diboll, and Oakhurst soils are in lower positions on the landscape than Keltys soil, and Laska soils are in similar positions. Also included are soils that are similar to Keltys soil but have a sandier subsoil or have parent material that is more than 60 inches deep, and also a few areas that have lignite coal in the substratum. These included soils make up about 25 percent of the map unit.

Most areas of this Keltys soil are used as woodland. The remaining acreage is used as cropland, hayland, or pastureland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too dry causes damage to vegetation, reduces organic matter, and increases erosion.

This soil is well suited to trees. It is best suited to pine trees. There are no special restrictions for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is moderately suited to most urban uses if special design and proper installation procedures are used. Wetness is the main limitation.

Because of slow permeability, this soil is moderately suited to recreational uses.

This Keltys soil is in land capability subclass IIIe and in woodland ordination group 2o7.

KM—Kian and Mantachie soils, frequently flooded. These nearly level soils are on flood plains. Individual areas are elongated and range from 10 to several thousand acres. The average slope is about 0.5 percent.

This map unit is about 40 percent Kian soil, 35 percent Mantachie soil, and 25 percent other soils. These soils could be separated, but it was not practical to map them separately because flooding made the use very similar. Some parts of delineations are fairly uniform and dominated by one or the other of the named soils.

Typically, the Kian soil has a grayish brown loamy fine sand surface layer about 5 inches thick. The next layer, to a depth of about 60 inches, is fine sandy loam stratified with loam and loamy fine sand. It is dark gray in the upper part and grayish brown in the lower part. Reaction is neutral throughout. In some places, the soil is slightly saline below a depth of 40 inches.

The Kian soil is poorly drained. Runoff is very slow. The available water capacity is medium, and permeability is moderate. The root zone is deep and is easily penetrated by plant roots. The erosion hazard is slight. A seasonal water table is near the surface during the winter and spring.

Typically, the Mantachie soil has a surface layer about 13 inches thick. It is a dark brown loam in the upper part of the surface layer, and grades to brown fine sandy loam in the lower part. The next layer, to a depth of about 21 inches, is dark grayish brown clay loam. The next layer to a depth of about 60 inches is dark grayish brown loam. Reaction is very strongly acid throughout. In some places, the soil is slightly saline below a depth of 40 inches.

The Mantachie soil is somewhat poorly drained. Runoff is slow. The available water capacity is high, and permeability is moderate. A water table is at a depth of 1 foot to 1.5 feet during the winter. The root zone is deep and is easily penetrated by plant roots. The hazard of erosion is slight.

Included in mapping are small areas of Pluck, Pophers, and Ozias soils. Also included are areas of soils that are similar to Kian soil but are somewhat poorly drained and areas of soils that are only occasionally flooded or have a clay loam surface layer.

Most areas of these soils are in woodland. The remaining acreage is in pastureland or hayland. These soils are poorly suited to cropland because they are frequently flooded.

The use of the soils in this map unit as pastureland or hayland is effective in controlling erosion, but flooding restricts the use of these soils for pastureland or hayland. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use when the soil is flooded or during other periods of wetness help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too wet causes soil compaction and increases runoff.

The soils in this map unit are well suited to water-tolerant hardwood trees. Wetness and flooding are severe limitations for planting or harvesting trees. Before harvesting, the chemical properties of these soils should be evaluated because these properties will affect the success of future reseeding operations.

These soils are poorly suited to most urban and recreation uses. Wetness and flooding are the main limitations. The flooding limitation is difficult and costly to overcome.

The Kian and Mantachie soils are in land capability subclass Vw. The Kian soil is in woodland ordination group 2w9a and the Mantachie soil is in woodland ordination group 1w9.

KvA—Kirbyville fine sandy loam, 0 to 2 percent slopes. This is a nearly level to gently sloping soil on broad flats that typically contain a few low mounds. Individual areas are irregular in shape and range from 150 to about 3,000 acres. The average slope is about 0.5 percent.

Typically, this soil has a fine sandy loam surface layer about 12 inches thick. It is dark grayish brown in the upper part and light yellowish brown in the lower part.

The subsoil to a depth of 72 inches is sandy clay loam. It is yellowish brown in the upper 16 inches of the subsoil, and below that, it is brownish yellow. Reaction is medium acid in the surface layer, and below that, it is strongly acid grading to very strongly acid.

This soil is somewhat poorly drained. Runoff is slow. The available water capacity is high, and permeability is moderate. A seasonal water table is at a depth of 1.5 to 2.5 feet of the surface during the winter. The surface layer is friable and is easily tilled throughout a wide range of moisture content. It has a tendency to form a compacted layer if the soil is tilled when too wet or if tilled too often. The erosion hazard is slight.

Included with this soil in mapping are small areas of Dallardsville, Otanya, Sorter, and Waller soils. Dallardsville soils are in similar positions on the landscape as Kirbyville soil, Otanya soils are in higher positions, and Sorter and Waller soils are in lower positions. Also included are soils that are similar to Kirbyville soil, but have a loamy fine sand surface. These included soils make up about 45 percent of the map unit.

Most areas of the Kirbyville soil are used as woodland. The remaining acreage is used as cropland, pastureland, or hayland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor soil tilth.

This soil is well suited to pine and hardwood trees. Seasonal wetness is a moderate limitation for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is moderately suited to most urban uses. Wetness is the main limitation. This limitation can be partially overcome by special design and proper installation.

Because of wetness, this soil is moderately suited to recreational uses.

This Kirbyville soil is in land capability subclass IIw and in woodland ordination group 1w8.

LaB—Laska fine sandy loam, 1 to 5 percent slopes. This is a gently sloping soil on ridges of uplands. Individual areas are oval and irregular in shape and range from 10 to about 300 acres. The average slope is about 3 percent.

Typically, this soil has a fine sandy loam surface layer about 19 inches thick. It is grayish brown in the upper part and grades to brown in the lower part. The subsoil, to a depth of 83 inches, is pale brown fine sandy loam in the upper part and pale brown loamy very fine sand in the lower part. The substratum to a depth of about 85 inches is very pale brown fine sandy loam. Reaction is strongly acid in the upper part of the profile and grades to slightly acid in the lowest layer.

This soil is moderately well drained. Runoff is very slow. The available water capacity is medium, and permeability is moderately rapid. A seasonal water table is at a depth of 1.5 to 3 feet during the winter. The surface layer is loose. Excessive moisture loss is common if the soil is tilled. The erosion hazard is slight.

Included with this soil in mapping are small areas of Colita, Diboll, Keltys, and Oakhurst soils. Colita, Diboll, and Oakhurst soils are in lower positions on the landscape than Laska soil, and Keltys soil is in similar positions. Also included are soils that are similar to Laska soil but have a more clayey subsoil or have parent material within 60 inches of the surface. Also included are a few areas that have lignite coal in the substratum. These included soils make up about 25 percent of the map unit.

Most areas of this Laska soil are used as woodland. The remaining acreage is used as cropland, hayland, or pastureland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too dry causes damage to vegetation, reduces organic matter, and increases the hazard of erosion.

This soil is well suited to trees, and it is best suited to pine trees. Seasonal wetness or droughtiness is a moderate limitation for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is moderately suited to most urban uses if special design and proper installation procedures are used. Wetness is the main limitation.

Because of wetness, this soil is moderately suited to recreational uses.

This Laska soil is in land capability subclass IIw and in woodland ordination group 2w8a.

LgB—Leggett fine sandy loam, 0 to 3 percent slopes. This is a nearly level to gently sloping soil on flats, slightly concave toe slopes, and heads of drainageways. Individual areas are oval to irregular in shape and range from 4 to about 300 acres. The average slope is about 2 percent.

Typically, this soil has a fine sandy loam surface layer about 12 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The subsoil, to a depth of 72 inches, is sandy clay loam that is mottled grayish brown and brownish yellow in the

upper part and grades to light brownish gray and grayish brown in the lower part. It is tongued and mixed with grayish brown fine sandy loam. Reaction is strongly acid in the surface layer and very strongly acid in the subsoil.

This soil is somewhat poorly drained. Runoff is slow. The available water capacity is high, and permeability is moderate. A seasonal water table is near the surface during the winter. The surface layer is friable and is easily tilled throughout a wide range of moisture content. It has a tendency to form a plow pan, especially if the soil is tilled when too wet or if tilled too often. The erosion hazard is slight.

Included with this soil in mapping are small areas of Choates, Colita, Kian, Laska, Pinetucky, Pluck, and Woodville soils. Choates, Laska, Pinetucky, and Woodville soils are in higher positions on the landscape than Leggett soil, Colita soils are in lower positions, and Kian and Pluck soils are on the flood plains. Also included are soils that are similar to Leggett soil but have a loamy fine sand surface or are poorly or moderately well drained. These included soils make up about 35 percent of the map unit.

Most areas of this Leggett soil are in woodland. The remaining acreage is in pastureland, hayland, or cropland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during the wet periods help to keep the pasture and soil in good condition. Overgrazing or grazing when the soil is too wet causes surface compaction and poor soil tilth and increases runoff.

This soil is well suited to pine trees. Wetness is a moderate limitation for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is poorly suited to most urban uses because of wetness. It has insufficient strength and stability to support vehicular traffic, but this low strength limitation can be corrected by strengthening or replacing the base material. Wetness is a limitation for septic tank absorption fields, but this limitation can be partially overcome by increasing the size of the absorption field or installing a central sewage treatment system.

Because of wetness, this soil is poorly suited to recreation uses.

This Leggett soil is in land capability subclass IIIw and in woodland ordination group 3w8a.

MoB—Moswell fine sandy loam, 1 to 5 percent slopes. This is a gently sloping soil on upland convex ridges and side slopes. Individual areas are irregular in shape and range from 10 to about 150 acres. The average slope is about 3 percent.

Typically, this soil has a very dark grayish brown fine sandy loam surface layer about 5 inches thick. The subsoil extends to a depth of about 47 inches. The upper part of the subsoil is yellowish red clay, the middle part is reddish brown clay, and the lower part is mottled dark reddish brown and yellow shaly clay. The substratum is brownish yellow shaly clay to a depth of 60 inches. Reaction is strongly acid in the surface layer, and it is extremely acid in the subsoil and substratum.

This soil is moderately well drained. Runoff is moderate. The available water capacity is medium, and permeability is slow. A seasonal water table is at a depth of 3.5 to 5 feet during the winter. The surface layer is friable, but it is difficult to till through a narrow range of moisture content. The surface will crust or puddle after heavy rains if the plow layer is thin and contains subsoil material. Root development is restricted below the surface layer because of the dense clayey subsoil. The erosion hazard is severe.

Included with this soil in mapping are small areas of Colita, Diboll, Herty, Keltys, Laska, and Wiergate soils. Colita, Diboll, and Herty soils are in lower positions on the landscape than Moswell soil, and Keltys and Laska soils are in similar positions. Also included are some areas of Moswell and Wiergate soils that have slopes of more than 5 percent. These included soils make up about 30 percent of the map unit.

Most areas of this Moswell soil are in woodland. The remaining acreage is in cropland, hayland, or pastureland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too wet causes compaction and poor soil tilth and increases water runoff.

This soil is moderately suited to pine trees. Wetness is a moderate limitation for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is poorly suited to most urban uses. High shrink-swell potential, low strength, and wetness are the main limitations. When saturated, this soil does not have sufficient strength and stability to support vehicular traffic, but this low strength limitation can be corrected by strengthening or replacing the base material. The very slow permeability of this soil is a limitation to use as septic tank absorption fields, but this limitation can be overcome by installing a central sewage treatment plant.

Because of very slow permeability, this soil is poorly suited to most recreation uses.

This Moswell soil is in land capability subclass IVe and in woodland ordination group 3c8.

MoD—Moswell fine sandy loam, 5 to 12 percent slopes. This is a sloping to strongly sloping soil on upland convex side slopes. Individual areas are elongated to irregular in shape and range from 5 to about 50 acres. The average slope is about 8 percent.

Typically, this soil has a grayish brown fine sandy loam surface layer about 4 inches thick. The subsoil to a depth of 50 inches is yellowish red and red clay in the upper part and mottled light gray and brownish yellow clay in the lower part. The underlying material is brownish yellow shaly clay. Reaction ranges from medium acid to extremely acid.

This soil is moderately well drained. Runoff is rapid. The available water capacity is medium, and permeability is very slow. A seasonal water table is at a depth of 3.5 to 5 feet during the winter. Root development is restricted below the surface layer because of compaction and high clay content of the subsoil. The erosion hazard is severe.

Included with this soil in mapping are small areas of Diboll, Keltys, and Rayburn soils. Diboll soils are in lower positions on the landscape than Moswell soil, and Keltys and Rayburn soils are in similar positions. Also included are spots of Wiergate and Burkeville soils that are clayey throughout. These included soils make up about 30 percent of the map unit.

Most areas of this Moswell soil are used as woodland. The remaining acreage is used as pastureland or hayland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too wet causes compaction and poor soil tilth and increases runoff.

This soil is moderately suited to pine trees. Saturation during the winter, high clay content, and slope are moderate limitations for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is poorly suited to most urban uses. High shrink-swell potential, low strength, and wetness are the main limitations. When saturated, this soil does not have sufficient strength and stability to support vehicular traffic, but this low strength limitation can be corrected by strengthening or replacing the base material. The very slow permeability of this soil is a limitation to use as septic tank absorption fields, but this limitation can be overcome by installing a central sewage treatment plant.

Because of wetness, this soil is poorly suited to most recreational uses. Slope limits the use of this soil for playgrounds.

This Moswell soil is in land capability subclass VIe and in woodland ordination group 3c8.

Na—Nahatche fine sandy loam, rarely flooded. This is a nearly level soil on flood plains. Individual areas are elongated and irregular and range from 50 to about 600 acres. The average slope is about 0.5 percent.

Typically, this soil has a dark grayish brown fine sandy loam surface layer about 6 inches thick. The underlying material to a depth of 55 inches is stratified grayish brown loam, very fine sandy loam and clay loam, and to a depth of 72 inches, it is dark grayish brown clay loam. Reaction is slightly acid or medium acid in the upper part of the profile and strongly acid in the lower part.

This soil is somewhat poorly drained. Runoff is slow. The available water capacity is medium, and permeability is moderate. A seasonal water table is near the surface during the winter and spring. The surface layer is very friable and is easily tilled throughout a wide range of moisture content. This soil has a tendency to become saturated during the winter, and plowpans form if it is tilled often. The root zone is deep and is easily penetrated by plant roots. The erosion hazard is slight.

Included with this soil in mapping are small areas of Bernaldo, Bienville, Hatliff, Kaman, and Voss soils. Bernaldo and Bienville soils are in higher positions on the landscape than Nahatche soil. Hatliff, Kaman, and Voss soils are on the flood plain. Also included is a soil that is similar to Nahatche soil but has a sandy layer below 30 inches. Also included are a few areas of Nahatche soils that are flooded more often. These included soils make up about 35 percent of the map unit.

Most areas of this Nahatche soil are used as pastureland. The remaining acreage is used as cropland, woodland, or hayland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too wet causes compaction and poor soil tilth.

This soil is well suited to pine and hardwood trees. Wetness during the winter is a severe limitation for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is poorly suited to most urban uses. Wetness is the main limitation. Saturation during the winter is a limitation to use as septic tank absorption fields, but this wetness limitation can be partially overcome by increasing the size of the absorption field.

Because of wetness, this soil is poorly suited to most recreational uses.

This Nahatche soil is in land capability subclass IIw and in woodland ordination group 1w9.

OaB—Oakhurst very fine sandy loam, 1 to 5 percent slopes. This is a gently sloping soil on broad, smooth, upland ridges and flats. Individual areas are irregular in shape and range from 14 to about 500 acres. The average slope is about 2 percent.

Typically, this soil has a very fine sandy loam surface layer about 7 inches thick. It is dark gray in the upper part and grayish brown in the lower part. The subsoil extends to a depth of 46 inches. It is dark grayish brown clay in the upper part of the subsoil and gray in the lower part. The substratum to a depth of 65 inches is light gray volcanic tuff of silty clay loam texture. Reaction ranges from strongly acid to mildly alkaline.

This soil is somewhat poorly drained. Runoff is medium. The available water capacity is medium, and permeability is very slow. A perched water table is near the surface during the winter. The surface layer is friable and is easily tilled throughout a wide range of moisture content. The surface layer has a tendency to crust or puddle after heavy rains. The soil is saturated during the winter and droughty during the summer. The erosion hazard is moderate.

Included with this soil in mapping are small areas of Burkeville, Colita, Diboll, Herty, Keltys, Laska, Moswell, Wiergate, and Woodville soils. Burkeville, Herty, Keltys, Laska, Moswell, Wiergate, and Woodville soils are in higher positions on the landscape than Oakhurst soil, and Colita and Diboll soils are in lower positions. Also included are soils that are similar to Oakhurst soil but have a surface layer that is more than 10 inches thick, and also some soils that are thinner than 40 inches or that have as much as 15 percent pebbles in the surface layer. Also included are areas of Oakhurst soils that have slopes less than 1 percent or more than 5 percent. These included soils make up about 45 percent of the map unit.

Most areas of this Oakhurst soil are pastureland. The remaining acreage is in woodland, cropland, or hayland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet and dry periods help to keep the pasture and soil in good condition. Overgrazing or grazing when the soil is too wet causes compaction, excessive runoff, and poor soil tilth.

This soil is poorly suited to pine trees. Before harvesting, the chemical properties of this soil should be evaluated because these properties will affect the success of future reseeding operations. A slow but continuous die-off of seedlings and young trees will occur if this soil is not properly managed. Wetness and heavy clay content are severe limitations for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is poorly suited to most urban uses. The shink-swell potential, low strength, and wetness are the main limitations. This soil does not have sufficient strength to support vehicular traffic, but this can be corrected by adding lime or replacing the base material. The very slow permeability of this soil is a limitation for septic tank absorption fields, but this limitation can be overcome by installing a central sewage treatment plant.

Because of wetness and very slow permeability, this soil is poorly suited to most recreational uses.

This Oakhurst soil is in land capability subclass IVe and in woodland ordination group 4w9.

OaC—Oakhurst very fine sandy loam, 5 to 8 percent slopes. This is a sloping soil on upland side slopes. Individual areas are irregular in shape and range from 7 to about 150 acres.

Typically, this soil has a very fine sandy loam surface layer about 7 inches thick. It is dark gray in the upper part and gray in the lower part. The subsoil, to a depth of 47 inches, is dark grayish brown clay in the upper part and gray clay in the lower part. The underlying material to a depth of about 65 inches is light gray volcanic tuff of silty clay loam texture. Reaction ranges from medium acid to mildly alkaline.

This soil is somewhat poorly drained. Runoff is medium. The available water capacity is medium, and permeability is very slow. A perched water table is near the surface during the winter. The surface layer is friable and is easily tilled throughout a wide range of moisture content. The soil is saturated during the winter and droughty during the summer. The erosion hazard is severe.

Included with this soil in mapping are small areas of Burkeville, Colita, Diboll, Herty, Keltys, Laska, Moswell, Wiergate, and Woodville soils. Colita and Diboll soils are in lower positions on the landscape than Oakhurst soil. The other soils are in similar positions on the landscape. Also included are soils that are similar to Oakhurst soil but have a surface layer that is more than 10 inches thick; some soils that are thinner than 40 inches or that have about 15 percent pebbles in the surface layer; some areas of Oakhurst soils that have slopes less than 5 percent; and some areas that are eroded. These included soils make up about 45 percent of this map unit.

Most areas of this Oakhurst soil are in pastureland. The remaining acreage is in woodland or hayland. This soil is not suited to cropland because of the hazard of erosion.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet and dry periods help to keep the pasture and soil in good condition. Overgrazing or grazing when the soil is too wet causes compaction, excessive runoff, and poor soil tilth.

This soil is poorly suited to pine trees. Wetness is a moderate limitation for planting or harvesting trees. Before harvesting, the chemical properties of this soil should be evaluated because these properties will affect the success of future reseeding operations. A slow but continuous die-off of seedlings and young trees will occur if the soil is not properly managed.

This soil is poorly suited to most urban uses. The shrink-swell potential, low strength, and wetness are the main limitations. This soil cannot support vehicular traffic because of low soil strength and high shrink-swell potential. These limitations can be corrected by adding lime or by replacing the base material. The very slow permeability of this soil is a limitation to use as septic tank absorption fields, but this limitation can be overcome by installing a central sewage treatment plant.

Because of wetness and very slow permeability, this soil is poorly suited to most recreational uses. Slope is a limitation for playgrounds.

This Oakhurst soil is in land capability subclass VIe and in woodland ordination group 4w9.

OtA—Otanya fine sandy loam, 0 to 3 percent slopes. This is a nearly level to gently sloping soil on broad, smooth, convex uplands. Individual areas are irregular in shape and range from 20 to about 1,500 acres. The average slope is about 0.5 percent.

Typically, this soil has a fine sandy loam surface layer about 9 inches thick. It is dark grayish brown in the upper part and very pale brown in the lower part. The subsoil, to a depth of 65 inches, is strong brown sandy clay loam. Reaction ranges from slightly acid in the upper part of the soil and grades to very strongly acid in the lower part.

This soil is moderately well drained. Runoff is slow to medium. The available water capacity is high, and permeability is moderately slow. A perched water table is at a depth of 3 to 5 feet during the winter. The surface layer is friable and is easily tilled throughout a wide range of moisture content. This soil has a tendency to form compacted layers if it is tilled when wet or if tilled too often. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Boykin, Conroe, Doucette, Kirbyville, and Splendora soils. Boykin, Conroe, and Doucette soils are in similar positions on the landscape as Otanya soil, and Kirbyville and Splendora soils are in lower positions. Also included are areas of soils that are similar to Otanya soil in which the surface layer and the upper subsoil contain 10 to 25 percent, by volume, of ironstone pebbles. These included soils make up about 30 percent of the map unit.

Most areas of this Otanya soil are used as woodland. The remaining acreage is used as cropland, hayland, or pastureland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the soil in good condition. Overgrazing or grazing when the soil is too wet or too dry causes surface compaction, excessive runoff, and poor soil tilth.

This soil is well suited to pine trees. There are no special restrictions for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is moderately suited to most urban uses. Seasonal wetness and moderately slow permeability are the main limitations. Wetness and low soil strength are moderate limitations for local streets and roads, but these limitations can be overcome by strengthening or replacing the base material and by installing a drainage system. The moderately slow permeability of this soil is a limitation to use as septic tank absorption fields, but this limitation can be overcome in some places by increasing the size of the absorption field.

Because of its slow permeability, this soil is moderately suited to most recreational uses.

This Otanya soil is in land capability subclass IIe and in woodland ordination group 1o7.

Oz—Ozias-Pophers complex, frequently flooded. The nearly level soils in this complex are on major flood plains. Individual areas are elongated and range from 20 to several hundred acres. The average slope is about 0.3 percent.

This complex is about 45 percent Ozias soil, 40 percent Pophers soil, and 15 percent other soils. The soils in this map unit were so intricately mixed that it was not practical to map them separately.

Typically, the Ozias soil has a dark brown silty clay loam surface layer about 5 inches thick. The subsoil, to a depth of about 19 inches, is dark grayish brown silty clay. The next layers are dark grayish brown clay loam to a depth of 60 inches. Reaction is very strongly acid throughout.

The Ozias soil is somewhat poorly drained. Runoff is very slow. The available water capacity is medium, and permeability is very slow. A seasonal water table is at a depth of 1 foot to 2 feet during winter and spring. The erosion hazard is slight.

Typically, the Pophers soil has a surface layer that is dark brown silty clay loam about 2 inches thick. The subsoil, to a depth of about 9 inches, is dark yellowish brown silty clay loam. The next layer, to a depth of 20 inches, is a gray silty clay loam, and the lower part of the subsoil to a depth of 60 inches is gray clay loam. Reaction is strongly acid throughout.

The Pophers soil is somewhat poorly drained. Runoff is slow. The available water capacity is medium, and permeability is slow. A seasonal water table is at a depth

of 1 foot to 2 feet during the winter and spring. The erosion hazard is slight.

Included in mapping are small areas of Mantachie and Kian soils. Also included are soils that are similar to Ozias soil. These soils are ponded. The included soils are in similar positions on the flood plains as the Ozias and Pophers soils.

Most areas of the soils in this map unit are in woodland. These soils are flooded several times during the year and therefore are not suited to use as cropland.

The use of the soils in this map unit as pastureland is effective in controlling erosion. Flooding and other periods of wetness restrict the use of these soils for pastureland. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use when the soil is flooded help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too wet causes surface compaction and increases runoff.

The soils in this map unit are well suited to water-tolerant hardwood trees. Flooding and soil wetness are severe limitations for planting or harvesting trees. Seedlings are often destroyed during periods of flooding. Before harvesting, the chemical properties of these soils should be evaluated because these properties will affect the success of future reseeding operations. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

These soils are poorly suited to most urban uses. Flooding and soil wetness are the main limitations. The flooding limitation is difficult and costly to overcome.

Because of flooding, wetness, very slow permeability, and clayey texture, these soils are poorly suited to recreational uses.

The soils in this complex are in land capability subclass Vw and in woodland ordination group 1w6b.

PaB—Pinetucky loamy fine sand, 1 to 5 percent slopes. This is a gently sloping soil on broad, convex uplands. Individual areas are irregular in shape and range from 40 to about 2,000 acres. The average slope is about 3 percent.

Typically, this soil has a loamy fine sand surface layer about 16 inches thick. It is grayish brown in the upper part and pale brown in the lower part. The subsoil extends to a depth of about 60 inches. It is a brownish yellow sandy clay loam to a depth of 32 inches. Below that, it is mottled brownish yellow, red, and light gray sandy clay loam that contains plinthite. Reaction is strongly acid or very strongly acid throughout.

This soil is moderately well drained. Runoff is slow to medium. The available water capacity is high, and permeability is moderately slow. The surface layer is friable and is easily tilled throughout a wide range of moisture content. This soil has a tendency to compact if it is tilled when wet or if tilled too often. The erosion hazard is moderate.

Included with this soil in mapping are small areas of Boykin, Choates, Conroe, Dallardsville, Leggett, Stringtown, and Woodville soils. Choates, Dallardsville, and Leggett soils are in lower positions on the landscape than Pinetucky soil, and Boykin, Choates, Conroe, Stringtown, and Woodville soils are in similar positions. Also included are soils that are similar to Pinetucky soil in which the surface layer and upper part of the subsoil contain 15 to 25 percent, by volume, ironstone pebbles, and also some areas of Pinetucky soils that have a fine sandy loam texture. These included soils make up about 40 percent of the map unit.

Most areas of this Pinetucky soil are used as woodland. The remaining acreage is used as hayland, pastureland, or cropland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too wet or too dry causes surface compaction, excessive runoff, and poor soil tilth.

This soil is well suited to pine trees. There are no special restrictions for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is moderately well suited to most urban uses. Low strength and moderately slow permeability are the main limitations. This soil is moderately well suited to local roads and streets. Wetness and low soil strength are limitations, but these limitations can be overcome by strengthening or replacing the base material and by installing a drainage system. The moderately slow permeability of this soil is a limitation to use as septic tank absorption fields, but this limitation can be partially overcome by increasing the size of the absorption field.

Because of slow permeability, this soil is moderately suited to most recreational uses.

This Pinetucky soil is in land capability subclass IIIe and in woodland ordination group 2o7.

PfB—Pinetucky fine sandy loam, 1 to 5 percent slopes. This is a gently sloping soil on broad, smooth, upland plains. Individual areas are irregular in shape and range from 30 to about 800 acres. The average slope is about 3 percent.

Typically, this soil has a fine sandy loam surface layer about 12 inches thick. It is dark grayish brown in the upper part of the surface layer and pale brown in the lower part. The subsoil, to a depth of about 28 inches, is yellowish brown sandy clay loam. The next layer to a depth of 56 inches is yellowish brown sandy clay loam

that contains plinthite and has mottles in shades of red and brown. The lower layer to a depth of 70 inches is mottled, light gray, red, and strong brown sandy clay loam that contains plinthite. Reaction in the surface layer is medium acid and grades to very strongly acid in the subsoil.

The soil is moderately well drained. Runoff is slow to medium. The available water capacity is high, and permeability is moderately slow. The surface layer is friable and is easily tilled throughout a wide range of moisture content. This soil has a tendency to form compacted layers if it is tilled when wet or if tilled too often. The hazard of erosion is moderate.

Included with this soil in mapping are small areas of Boykin, Choates, Conroe, Dallardsville, Doucette, Leggett, Stringtown, and Woodville soils. Choates, Dallardsville, and Leggett soils are in lower positions on the landscape than Pinetucky soil. Boykin, Conroe, Doucette, Stringtown, and Woodville soils are in similar positions as Pinetucky soil. Also included are soils that are similar to Pinetucky soil in which the surface layer and upper part of the subsoil contain 10 to 25 percent, by volume, of ironstone pebbles. These included soils make up 30 percent of the map unit.

Most areas of this Pinetucky soil are in woodland. The remaining acreage is in cropland, hayland, or pastureland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too wet or too dry causes surface compaction, excessive runoff, and poor soil tilth.

This soil is well suited to pine trees. There are no special restrictions for planting or harvesting trees (fig. 5). If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is moderately suited to most urban uses. Seasonal wetness and moderately slow permeability are main limitations. This soil is moderately suited to local streets and roads. When saturated, this soil cannot support vehicular traffic because of its low strength and stability, but the wetness and low strength limitations can be overcome by strengthening or replacing the base material and by installing a drainage system. The moderately slow permeability of this soil is a limitation to use as septic tank absorption fields, but this limitation can be partially overcome by increasing the size of the absorption field.

Because of moderately slow permeability, this soil is moderately suited to most recreational uses.

This Pinetucky soil is in land capability subclass IIIe and in woodland ordination group 2o7.

PGB—Pinetucky and Conroe soils, graded. The nearly level to gently sloping soils in this map unit are on convex uplands that have been altered by the mechanical removal of ironstone gravel from the surface layer. Individual areas vary in shape, but commonly have one or more straight sides and range from 4 to about 250 acres. The average slope is about 2 percent.

This map unit is about 50 percent Pinetucky soil, about 25 percent Conroe soil and 25 percent other soils. However, some delineations may be composed almost entirely of either Pinetucky or Conroe soils. The soils were mapped as one unit because features, use, and management are similar after the surface layer is removed.

Typically, the Pinetucky soil has a yellowish brown fine sandy loam surface layer about 2 inches thick. The subsoil extends to a depth of 60 inches. It is yellowish brown sandy clay loam in the upper part grading to yellowish brown sandy clay loam mottled in shades of yellow, red, and gray in the lower part. Reaction is very strongly acid throughout.

The Pinetucky soil is moderately well drained. Runoff is medium. The available water capacity is high, and permeability is moderately slow. The erosion hazard is severe.

Typically, the Conroe soil has a light yellowish brown gravelly loamy fine sand surface layer about 3 inches thick. The subsoil extends to a depth of about 60 inches. It is yellowish brown sandy clay loam in the upper part grading to strong brown, red and yellow sandy clay in the lower part. Reaction is very strongly acid throughout.

The Conroe soil is moderately well drained. Runoff is slow. The available water capacity is medium, and permeability is slow. The hazard of erosion is severe. A perched water table is at 2 to 3.5 feet during winter and spring.

Included in mapping are small areas of Conroe and Pinetucky soils that do not have the surface removed. Also included are areas of sandy or loamy soils containing varying amounts of gravel that are remnants of the stockpiled gravel material. Also included are areas of soils that are similar to Conroe and Pinetucky soils in which the original surface and subsurface layers and up to 10 inches of the subsoil have been removed.

Most areas of this map unit have been used for stripmining of ironstone pebbles. These abandoned stripmined areas are essentially idle land.

The use of the soils in this map unit as pastureland or hayland is effective in controlling erosion. A vegetative cover is generally difficult to establish and maintain because the present soil surface has very poor tilth and fertility, but this difficulty can be offset by adding topsoil or spreading any remaining topsoil material over the map unit area. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the vegetation and soil favorable for plant growth. Overgrazing or grazing when the soil is

Figure 5.—Undergrowth vegetation has been rolled down following clearcutting of timber on Pinetucky fine sandy loam, 1 to 5 percent slopes.

too wet or too dry causes surface compaction and poor soil tilth and increases runoff. This should be avoided especially during plant establishment.

Without special site preparation, the soils in this map unit are poorly suited to southern pine and hardwood trees for commercial production. The poor condition of the soil after an area has been stripmined is the main limitation for this use.

These soils are moderately well suited to most urban uses. Wetness and slow permeability are the main limitations. These limitations can be partially overcome if special design and proper installation procedures are used.

This map unit site is characterized by sparse vegetation. In its present state, these soils support only a scattered stand of poor quality grasses, forbs, and trees. The potential of the soils on this site is dependent upon many factors, such as the absence or presence of any topsoil, the amount of the subsoil removed, and the condition of the site when abandoned.

Because of the content of small stones and the moderately slow and slow permeability, the soils in this map unit are moderately suited to most recreational uses.

The Pinetucky and Conroe soils are in land capability subclass VIe and in woodland ordination group 4c3.

PK—Pluck and Kian soils, frequently flooded. The nearly level to gently sloping soils in this map unit are on flood plains of minor drainageways and major streams. Individual areas are elongated and slightly concave and range from 20 to about 2,000 acres. The average slope is about 0.7 percent.

This map unit is about 45 percent Pluck soil, about 30 percent Kian soil and 25 percent other soils. The Pluck soil mainly is on plain to slightly concave surfaces. The

Figure 6.—Floodwaters on Pluck and Kian soils, frequently flooded.

Kian soil mainly is on plain to slightly convex surfaces. It is not practical to map these soils separately because they are frequently flooded and because use and management are similar. Some parts of mapped areas are dominated by Pluck soil or by Kian soil.

Typically, the Pluck soil has a brown fine sandy loam surface layer about 6 inches thick. The underlying material, to a depth of 52 inches, is stratified, light brownish gray fine sandy loam, grayish brown and light brownish gray sandy clay loam, and it is dark gray silty clay loam to a depth of about 65 inches. Reaction is neutral in the surface layer and upper part of the underlying material. It is mildly alkaline in the lower part of the underlying material.

The Pluck soil is poorly drained. Runoff is slow. The available water capacity is high, and permeability is moderate. A seasonal water table is near the surface during the winter and spring. The surface layer is very friable and can be tilled throughout a wide range of moisture content. Flooding occurs in most years. In many areas, flood waters remain over the surface long enough to reduce plant growth. The erosion hazard is slight.

Typically, the Kian soil has a brown fine sandy loam surface layer about 4 inches thick. The subsoil, to a depth of 52 inches, is grayish brown and light brownish gray fine sandy loam, and to a depth of 65 inches, it is gray clay loam. Reaction is neutral throughout.

The Kian soil is poorly drained. Runoff is very slow. The available water capacity is medium, and permeability is moderate. A seasonal water table is near the surface during the winter and spring. The surface layer is friable and is easily tilled throughout a wide range of moisture content. Flooding occurs in most years. In many areas, flood waters remain on the surface long enough to reduce plant growth (fig. 6 and fig. 7). The erosion hazard is slight.

Included with these soils in mapping are small areas of Choates, Hatliff, Kaman, Leggett, Nahatche, and Voss soils. Hatliff and Voss soils are in higher parts on the flood plains. Kaman and Nahatche soils are in similar positions on the landscape as Pluck and Kian soils.

Choates and Leggett soils are on uplands. Also included are soils in areas that are less frequently flooded.

Most areas of Pluck and Kian soils are used as woodland. The remaining acreage is used as pastureland or hayland. The soils in this map unit are not suited to cropland because of frequent flooding.

The use of these soils for pastureland or hayland is effective in controlling erosion although their use is restricted because of the flooding hazard. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry or flooded periods help to keep the vegetation and soil in good condition.

These soils are well suited to water-tolerant hardwood trees. Flooding is a severe limitation for planting or harvesting trees. Seedlings are often destroyed during these periods of flooding. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and tree stand improvement.

The soils in this map unit are poorly suited to most urban uses. Flooding and wetness are the main limitations. The flooding limitation is difficult and costly to overcome.

The Pluck and Kian soils are in land capability subclass Vw and in woodland ordination group 2w9a.

Pp—Pophers silty clay loam, frequently flooded. This is a nearly level soil on flood plains of major drainageways. Individual areas are irregular in shape and range from 20 to several hundred acres. The average slope is about 0.6 percent.

Typically, this soil has a dark brown silty clay loam surface layer about 2 inches thick. The subsoil, to a depth of about 9 inches, is dark yellowish brown silty clay loam, and it is gray clay loam to a depth of 60

Figure 7.—The remains of a bridge that was washed downstream during a flood on Pluck and Kian soils, frequently floooded.

inches. Reaction is medium acid in the surface layer and very strongly acid in the subsoil. The lower part of the soil is slightly saline.

This soil is somewhat poorly drained. Runoff is slow. The available water capacity is medium, and permeability is slow. A seasonal water table is at a depth of 1 foot to 2 feet during the winter and spring. The surface layer is firm and can be tilled throughout a wide range of moisture content. The erosion hazard is slight.

Included with this soil in mapping are small areas of Kian, Mantachie, and Ozias soils. These included soils are in similar positions on the landscape as Pophers soil. Also included is a soil that is similar to Pophers soil but is more saline. These included soils make up about 30 percent of the map unit.

Most areas of Pophers soil are used as woodland. The remaining acreage is used as pastureland. This soil is not suited to cropland because it is frequently flooded.

The use of this soil as pastureland or hayland is effective in controlling erosion, but flooding restricts the use of this soil for pastureland or hayland. Proper stocking, pasture rotation, timely deferment of grazing and restricted use when the soil is flooded help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too wet causes soil compaction and poor soil tilth and increases water runoff.

This soil is well suited to hardwood trees. Wetness and flooding are severe limitations for planting or harvesting trees. Before harvesting, the chemical properties of this soil should be evaluated because these properties will affect the success of future reseeding operations. A slow but continuous die-off of seedlings and young trees will occur if this soil is not properly managed.

Because of flooding, this soil is poorly suited to most urban and recreational uses. This flooding limitation is difficult and costly to overcome.

This Pophers soil is in land capability subclass Vw and in woodland ordination group 1w6b.

RaB—Rayburn fine sandy loam, 1 to 5 percent slopes. This is a gently sloping soil on uplands. Individual areas are irregular in shape and range from 20 to about 200 acres. The average slope is about 3 percent.

Typically, this soil has a fine sandy loam surface layer about 7 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The subsoil, to a depth of 55 inches, is clay. The upper part of the subsoil is red, the middle part is mottled light brownish gray, red, and strong brown, and the lower part is mottled pale brown and strong brown. The substratum to a depth of 62 inches is light gray sandstone. Reaction is very strongly acid throughout.

This soil is moderately well drained. Runoff is moderate. The available water capacity is medium, and permeability is very slow. A perched water table is at a depth of 2.5 to 4.5 feet during the winter. The surface layer is friable and is easily tilled throughout a wide range of moisture content. The erosion hazard is severe.

Included with this soil in mapping are small areas of Colita, Kitterll, Laska, Moswell, and Woodville soils. Colita soils are in lower positions on the landscape than Rayburn soil; and Kitterll, Laska, Moswell, and Woodville soils are in similar positions. Also included are Rayburn soils that are in more sloping areas and in areas less than 40 inches deep. These included soils make up about 35 percent of the map unit.

Most areas of this Rayburn soil are used as woodland. The remaining acreage is used as cropland, hayland, or pastureland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet priods help to keep the pasture and soil in good condition. Overgrazing or grazing when the soil is too wet causes soil compaction, poor soil tilth, and excessive runoff.

This soil is moderately suited to pine and hardwood trees. The high clay content in the subsoil is a moderate limitation for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is poorly suited to most urban uses. Wetness, very slow permeability, high clay content, and shrink-swell potential are the main limitations. These limitations can be partially overcome if special design and proper installation procedures are used.

Slow permeability limits the use of this soil for most recreational uses.

This Rayburn soil is in land capability subclass IVe and in woodland ordination group 2c8.

RaD—Rayburn fine sandy loam, 5 to 15 percent slopes. This is a sloping to moderately steep soil on side slopes of uplands. Individual areas are irregular in shape and range from 10 to about 200 acres. The average slope is about 8 percent.

Typically, this soil has a fine sandy loam surface layer about 7 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The subsoil, to a depth of 55 inches is clay. It is red in the upper part; the next layer is mottled light brownish gray, red, and strong brown; the next layer is light brownish gray, strong brown, and red; and the lower part is mottled pale brown and strong brown. The substratum to a depth of 62 inches is light gray sandstone. Reaction is very strongly acid throughout.

This soil is moderately well drained. Runoff is rapid. The available water capacity is medium, and permeability is very slow. A perched water table is at a depth of 2.5

to 4.5 feet during the winter. The erosion hazard is severe.

Included with this soil in mapping are small areas of Colita, Kitterll, Laska, Moswell, and Woodville soils. Colita soils are in lower positions on the landscape than Rayburn soil. Kitterll, Laska, Moswell, and Woodville soils are in similar positions. Also included are soils in areas that are similar to Rayburn soil but are less than 40 inches deep or are less clayey. These included soils make up about 35 percent of the map unit.

Most areas of this Rayburn soil are used as woodland. The remaining acreage is used as pastureland. This soil is poorly suited to cropland because of the severe hazard of erosion.

The use of this soil as pastureland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use duirng dry periods help to keep the vegetation and soil in good condition. Overgrazing when the soil is too wet or too dry causes soils compaction and excessive runoff and reduces organic matter.

This soil is moderately suited to pine and hardwood trees. The high clay content in the subsoil is a moderate limitation for planting or harvesting trees. If the site is prepared adequately and the vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is poorly suited to most urban uses. Wetness, very slow permeability, high clay content, shrink-swell potential, and slope are the main limitations. These limitations can be partially overcome if special design and proper installation procedures are used.

Slope and permeability limit the use of this soil for recreational uses.

This Rayburn soil is in land capability subclass VIe and in woodland ordination group 2c8.

SoA—Sorter silt loam, 0 to 1 percent slopes. This is a nearly level soil in broad, smooth areas that typically contain a few low mounds. Individual areas are irregular in shape and range from 100 to about 3,000 acres. The average slope is about 0.2 percent.

Typically, this soil has a grayish brown silt loam surface layer about 4 inches thick. The subsurface layer, to a depth of about 10 inches, is light brownish gray loam. The subsoil extends to a depth of 65 inches. It is light brownish gray loam to a depth of 52 inches, and below that, it is gray silt loam. Reaction is medium acid throughout.

This soil is poorly drained. Runoff is very slow. The available water capacity is high, and permeability is slow. Water is on the surface or a perched water table is within 2.5 feet of the surface during the late fall, winter, and spring (fig. 8). The surface layer is friable and is easily tilled throughout a wide range of moisture content. This soil has a tendency to form a compacted layer if it is tilled when too wet or if tilled too often. The erosion hazard is slight.

Included with this soil in mapping are small areas of Dallardsville, Kirbyville, and Waller soils. Dallardsville and Kirbyville soils are in higher positions on the landscape than Sorter soil, and Waller soil is in shallow depressions. These included soils make up about 30 percent of the map unit.

Most areas of this Sorter soil are used as woodland. The remaining acreage is used as pastureland or hayland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, use of field drains, and restricted use during wet periods help to keep the pasture and soil in good condition. Overgrazing or grazing when the soil is too wet causes surface compaction and poor soil tilth, and a lower vegetative quality.

This soil is well suited to pine and water-tolerant hardwood trees. Wetness is a severe limitation for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is poorly suited to most urban uses. Wetness is the main limitation. During the winter and for extended periods after heavy rains, the soil is saturated throughout.

This soil is too wet for most recreational uses.

This Sorter soil is in land capability subclass IVw and in woodland ordination group 2w9b.

SpA—Splendora very fine sandy loam, 0 to 2 percent slopes. This is a nearly level to gently sloping soil on broad flats that typically contain a few low mounds. Individual areas are irregular in shape and range from 150 to about 300 acres. The average slope is about 0.2 percent.

Typically, this soil has a surface layer about 10 inches thick. It is dark grayish brown very fine sandy loam in the upper part and grayish brown fine sandy loam in the lower part. The subsoil extends to a depth of 95 inches. It is light yellowish brown loam to a depth of 20 inches. The next layer, to a depth of 22 inches, is light brownish gray loam. The next layers, to a depth of 69 inches, are mottled yellowish brown and strong brown and mottled yellowish brown and red sandy clay loam. The lower layer is mottled light gray, brownish yellow, and yellowish red sandy clay loam. Reaction is medium acid to strongly acid in the surface layer and is very strongly acid or strongly acid in the subsoil.

This soil is somewhat poorly drained. Runoff is slow. The available water capacity is medium, and permeability is slow. A perched water table is within 0.5 to 2.5 feet of the surface during the winter and spring. The surface layer is friable and is easily tilled throughout a wide range of moisture content. This soil has a tendency to

Figure 8.—Pasture can be established in this area of Sorter silt loam, 0 to 1 percent slopes, if surface drainage is used to remove excess water.

form a compacted layer if it is tilled when too wet or if tilled too often. The erosion hazard is slight.

Included with this soil in mapping are small areas of Dallardsville, Kirbyville, Otanya, Sorter, and Waller soils. Dallardsville, Kirbyville, and Otanya soils are in higher positions on the landscape than Splendora soil, and Sorter and Waller soils are in lower positions. Also included are soils that are similar to Splendora soil but have a loamy fine sand surface layer or do not have any brittle bodies in the subsoil. These included soils make up about 45 percent of the map unit.

Most areas of this Splendora soil are in woodland. The remaining acreage is in cropland, pastureland, or hayland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor soil tilth.

This soil is well suited to pine and water-tolerant hardwood trees. Seasonal wetness is a moderate limitation for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is poorly suited to most urban uses. Wetness is the main limitation. This limitation can be partially overcome if special design and proper installation procedures are used.

This soil is poorly suited to recreational uses. Wetness is a limitation for most recreational uses.

This Splendora soil is in land capability subclass IIw and in woodland ordination group 2w8a.

SrB—Spurger fine sandy loam, 1 to 5 percent slopes. This is a gently sloping soil on broad stream terraces. Individual areas are elongated to irregular in shape and range from 13 to about 100 acres. The average slope is about 2 percent.

Typically, this soil has a brown fine sandy loam surface layer about 8 inches thick. The subsoil, to a depth of about 31 inches, is red clay. The next layers, to a depth of about 56 inches, are red clay loam in the upper part and mottled light brownish gray and red sandy clay loam in the lower part. The substratum to a depth of 72 inches is mottled yellowish red and light brownish gray fine sandy loam. Reaction is strongly acid in the surface layer and very strongly acid in the subsoil and substratum.

This soil is moderately well drained. Runoff is slow. The available water capacity is medium, and permeability is slow. A perched water table is at a depth of 2.5 to 3.5 feet during the winter. The surface layer is friable and is difficult to till throughout a narrow range of moisture content. The surface will crust or puddle after heavy rains if the plow layer contains subsoil material. Root development is restricted below the surface layer because of compaction and high clay content of the subsoil. The erosion hazard is moderate.

Included with this soil in mapping are small areas of Bernaldo and Bienville soils. Bernaldo and Bienville soils are in higher positions on the landscape than Spurger soil. Also included are soils that are similar to Spurger soil but have a loamy fine sand surface layer, are somewhat poorly drained, have contrasting sandstone substratum, and have a grayer subsoil. These included soils make up about 30 percent of the map unit.

Most areas of this Spurger soil are used as woodland. The remaining acreage is used as pastureland or hayland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too wet causes compaction and poor soil tilth and increases water runoff.

This soil is well suited to pine trees. Saturation of the soil during the winter is a moderate limitation. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is moderately suited to most urban uses. The shrink-swell potential, slow permeability, and wetness are the main limitations. When saturated, this soil does not have sufficient strength and stability to support vehicular traffic, but the wetness limitation can be corrected by strengthening or replacing the base material. The slow permeability of this soil is a limitation to use as septic tank absorption fields, but the limitation can be overcome by installing a central sewage treatment system.

Because of slow permeability, this soil is moderately suited to most recreational uses.

This Spurger soil is in land capability subclass IIIe and in woodland ordination group 1w8.

SrD—Spurger fine sandy loam, 5 to 15 percent slopes. This is a moderately sloping to strongly sloping soil along drainageways on convex side slopes of stream terraces. Individual areas are elongated to irregular in shape and range from 15 to about 35 acres. The average slope is about 10 percent.

Typically, this soil has a brown fine sandy loam surface layer about 3 inches thick. The subsoil, to a depth of 48 inches, is clay. It is red in the upper part and red and light brownish gray in the lower part. Below that, it is sandy clay loam. Reaction is strongly acid throughout.

This soil is moderately well drained. Runoff is rapid. The available water capacity is medium, and permeability is slow. A perched water table is at a depth of 2.5 to 3.5 feet during the winter. The surface layer is friable and is difficult to till throughout a narrow range of moisture content. Root development is restricted below the surface layer because of compaction and high clay content of the subsoil. The erosion hazard is severe.

Included with this soil in mapping are small areas of Bernaldo, Bonwier, Pinetucky, and Stringtown soils. The included soils are on ridgetops and foot slopes. Also included are soils that are similar to Spurger soil but have a loamy fine sand surface layer or a loamy subsoil, and in a few places, these soils have a substratum that is light gray tuffaceous sandstone or shale. These included soils make up about 30 percent of the map unit.

Most areas of this Spurger soil are used as woodland. The remaining acreage is used as pastureland or hayland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too wet causes compaction and poor soil tilth and increases runoff.

This soil is well suited to pine trees. Seasonal wetness, high clay content, and slope are moderate limitations for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is poorly suited to most urban uses. The shrink-swell potential, slope, and wetness are the main limitations. When saturated, this soil does not have

sufficient strength and stability to support vehicular traffic, but the wetness limitation can be corrected by strengthening or replacing the base material. The slow permeability of this soil is a limitation to use as septic tank absorption fields, but the limitation can be overcome by installing a central sewage treatment plant.

Because of slope and slow permeability, this soil is moderately suited to most recreational uses.

This Spurger soil is in land capability subclass VIe and in woodland ordination group 1w8.

STE—Stringtown-Bonwier association, strongly sloping. The soils in this map unit are on side slopes of drainageways. Individual areas are elongated to oval and range from 20 to about 500 acres. Slopes range from about 5 to 15 percent.

This association is about 40 percent Stringtown soils, 30 percent Bonwier soils, and 30 percent minor soils. The Stringtown soils are mainly on convex, middle and upper side slopes. Bonwier soils are on crests and tops of ridges. Areas of these soils were large enough to map separately, but because of anticipated similar use and management, this was not done.

Typically, the Stringtown soil has a dark yellowish brown fine sandy loam surface layer about 5 inches thick. The subsurface layer is yellowish brown fine sandy loam to a depth of 8 inches. The subsoil extends to a depth of about 50 inches. It is strong brown sandy clay loam to a depth of 20 inches. Below that it is yellowish brown sandy clay loam. The substratum is soft sandstone and shale. Reaction is medium acid in the upper 30 inches, and below that it is very strongly acid.

The Stringtown soil is well drained. Runoff is rapid. The available water capacity is medium and permeability is moderate. The erosion hazard is severe.

Typically, the Bonwier soil has a dark brown fine sandy loam surface layer about 5 inches thick. The subsurface layer is yellowish brown fine sandy loam to a depth of 9 inches. The subsoil extends to a depth of 26 inches. It is yellowish red sandy clay in the upper part and strong brown sandy clay in the lower part. The substratum is a yellowish red sandstone to a depth of 40 inches. This soil is strongly acid in the upper 9 inches, and below that, it is very strongly acid.

The Bonwier soil is well drained. Runoff is medium to rapid. The available water capacity is low, and permeability is moderately slow. The erosion hazard is severe.

Included in mapping are small areas of Doucette, Leggett, Pinetucky, Choates, and Woodville soils. Doucette and Pinetucky soils are on smoother slopes than the Stringtown and Bonwier soils. Leggett and Choates soils are on lower slopes. Woodville soils are on slopes that are similar to Stringtown and Bonwier soils. Also included are areas of Stringtown and Bonwier soils that are eroded or that have slopes of more than 15 percent.

Most areas of these soils are in woodland. The remaining acreage is used as pastureland.

The use of these soils as pastureland is effective in controlling erosion. These soils should be carefully protected from erosion because of the steep slopes. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition. Overgrazing or grazing when the soil is too wet causes soil compaction and poor soil tilth and increases runoff.

The soils in this map unit are moderately suited to pine and hardwood trees. The clayey subsoil is a moderate limitation for planting or harvesting trees. If the site is prepared adequately and competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

These soils are well suited to most urban uses. The slope and clayey subsoil of the Bonwier soils are the main limitations. These soils have moderate strength and stability to support vehicular traffic, but this can be improved by strengthening or replacing the base material.

Because of slope, these soils are moderately suited to most recreational uses.

The soils in this association are in land capability subclass VIe. The Stringtown soil is in woodland ordination group 3o1, and the Bonwier soil is in woodland ordination group 4c2.

Vr—Voss sand, rarely flooded. This is a nearly level to gently sloping soil on low terraces along the Trinity River. These areas are protected from frequent flooding by the Lake Livingston dam. Individual areas are elongated and range from 10 to about 120 acres. The average slope is about 2 percent.

Typically, this soil is a dark grayish brown or grayish brown sand that has many strata that are mainly sand to a depth of 70 inches. Reaction is slightly acid throughout.

This soil is moderately well drained. Runoff is slow. The available water capacity is low, and permeability is rapid. A water table is at a depth of 2 to 5 feet for 6 to 10 months of the year. The erosion hazard is slight.

Included with this soil in mapping are small areas of Kian, Hatliff, and Pluck soils. These included soils are on the flood plains. Also included are soils that are similar to Voss soil but have a permanent water table more than 5 feet deep. These included soils make up about 35 percent of the map unit.

Most areas of this Voss soil are used as woodland. The remaining acreage is used as pastureland.

The use of the soil for pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the vegetation and soil in

good condition. Overgrazing or grazing when the soil is too dry causes compaction and poor soil tilth and increases runoff.

This soil is moderately suited to pine and hardwood trees. The sandy texture of this soil and seasonal wetness are moderate limitations for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is poorly suited to most urban uses. Flooding, wetness, and seepage are the main limitations. The flooding limitation is difficult and costly to overcome.

Because of the sandy surface layer, this soil is poorly suited to most recreational uses. Flooding limits the use of this soil for some recreational uses.

This Voss soil is in land capability subclass IVw and in woodland ordination group 3s8.

Vs—Voss sand, frequently flooded. This is a nearly level to gently sloping soil on low stream terraces on flood plains (fig. 9). This soil is flooded at least once a year. Individual areas are elongated and range from 10 to about 120 acres. The average slope is about 2 percent.

Typically, this soil has a dark grayish brown sand surface layer about 4 inches thick. The underlying material, to a depth of about 25 inches, is light brownish gray sand, and is light gray sand that has many strata of very pale brown sand to a depth of about 70 inches. Reaction is medium acid in the surface layer and neutral in the underlying material.

This soil is moderately well drained to somewhat poorly drained. Runoff is slow. The available water capacity is low, and permeability is rapid. A water table is at a depth of 2 to 5 feet for 6 to 10 months of the year. The erosion hazard is slight.

Included with this soil in mapping are small areas of Kian, Hatliff, and Pluck soils. These included soils are on

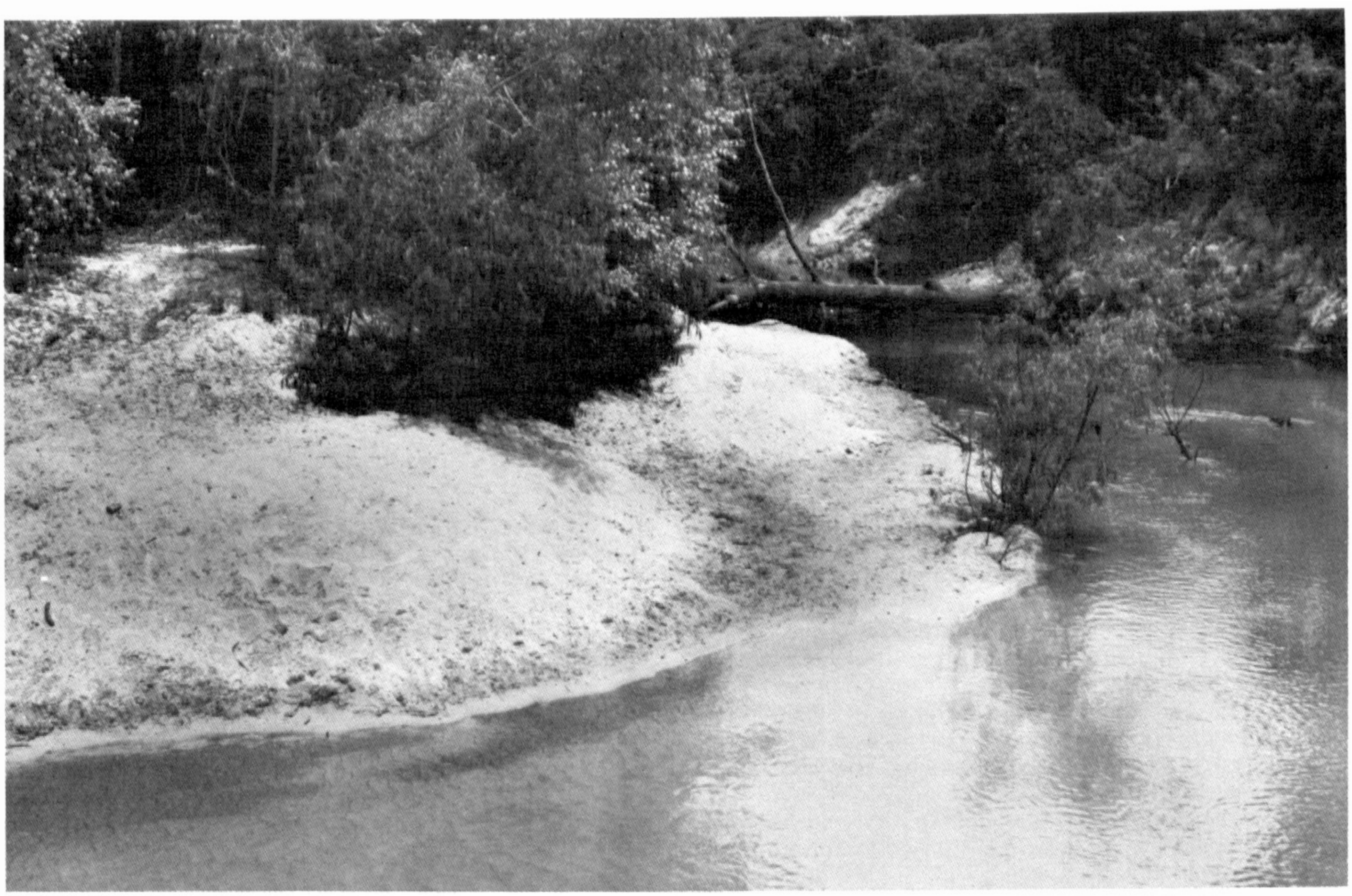


Figure 9.—Voss sand, frequently flooded, as it occurs adjacent to a stream.

the flood plains. Also included are soils that are similar to Voss soil, but they do not have a permanent high water table, and they are only occasionally flooded. Also included are areas of barren sand bars. These included soils make up about 45 percent of the map unit.

Most areas of this Voss soil are used as woodland. The remaining acreage is used as pastureland. This soil is not suited to cropland because of frequent flooding.

The use of this soil as pastureland or hayland is effective in controlling erosion, but flooding restricts the use of this soil for pastureland or hayland. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use when the soil is flooded or during other wet periods help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too wet causes compaction and poor soil tilth and increases runoff.

This soil is moderately suited to pine and hardwood trees. The sandy texture, wetness, and flooding are moderate limitations for planting or harvesting trees. Seedlings are often destroyed during periods of flooding. If the site is prepared adequately and the competing vegetation is controlled, most seedlings and young trees survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is poorly suited to most urban uses. Flooding is the main limitation, and this limitation is difficult and costly to overcome.

Because of flooding and the sandy surface layer, this soil is poorly suited to recreational uses.

This Voss soil is in land capability subclass VIw and in woodland ordination group 3s8.

WaA—Waller silt loam, 0 to 1 percent slopes. This is a nearly level soil in shallow, concave depressions and poorly defined drainageways. Individual areas are oval and range from 15 to about 140 acres. The average slope is about 0.2 percent.

Typically, this soil has a silt loam surface layer about 35 inches thick. It is grayish brown in the upper part and gray in the lower part. The subsoil, to a depth of 60 inches, is light brownish gray clay loam in the upper part and light brownish gray silty clay loam in the lower part. Reaction is strongly acid or very strongly acid throughout.

This soil is poorly drained. Runoff is slow to ponded. The available water capacity is high, and permeability is slow. A seasonal water table is at the surface or within 2.5 feet of the surface layer during the winter, spring, and early in the summer. The surface layer is friable and is easily tilled throughout a wide range of moisture content. This soil has a tendency to form a compacted layer if it is tilled when too wet or if tilled too often. The erosion hazard is slight.

Included with this soil in mapping are small areas of Dallardsville, Kirbyville, Splendora, and Sorter soils. Sorter soils are in similar positions on the landscape as Waller soil, and Dallardsville, Kirbyville, and Splendora soils are in slightly higher positions. These included areas make up about 35 percent of the map unit.

Most areas of the Waller soil are used as woodland. The remaining acreage is used as pastureland or hayland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, use of field drains, and restricted use during wet periods help to keep the pasture and soil in good condition. Overgrazing and grazing when the soil is too wet causes surface compaction, poor tilth, and a lower vegetative quality.

This soil is well suited to water-tolerant hardwood trees. Wetness is a severe limitation for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is poorly suited to most urban uses. The soil is saturated throughout during the winter and for extended periods after heavy rains. The wetness limitation can be partially overcome if special design and proper installation procedures are used.

Because of wetness, this soil is poorly suited to recreational uses.

This Waller soil is in land capability subclass IIIw and in woodland ordination group 2w9b.

WgB—Wiergate clay, 1 to 5 percent slopes. This is a gently sloping soil on broad, upland areas. Individual areas are irregular in shape and range from 5 to about 1,400 acres.

Typically, this soil has a very dark gray clay surface layer about 24 inches thick. The subsoil to a depth of 60 inches is olive gray clay in the upper part and pale olive clay in the lower part. Reaction is mildly alkaline in the surface layer and moderately alkaline and calcareous in the subsoil.

This soil is somewhat poorly drained. Runoff is slow to medium. The available water capacity is high, and permeability is very slow. A perched water table is within 2 feet of the surface during the winter. The erosion hazard is severe.

Included with this soil in mapping are small areas of Burkeville and Woodville soils. These included soils are more steeply sloping than Wiergate soil. Also included are a few areas of soils that are similar to Wiergate soil, but they do not have carbonates. These included soils make up about 35 percent of the map unit.

Most areas of this Wiergate soil are used as pastureland (fig. 10). The remaining acreage is used as hayland, woodland, or cropland.

The use of the soil for pastureland or hayland is effective in controlling erosion (fig. 11). Proper stocking,

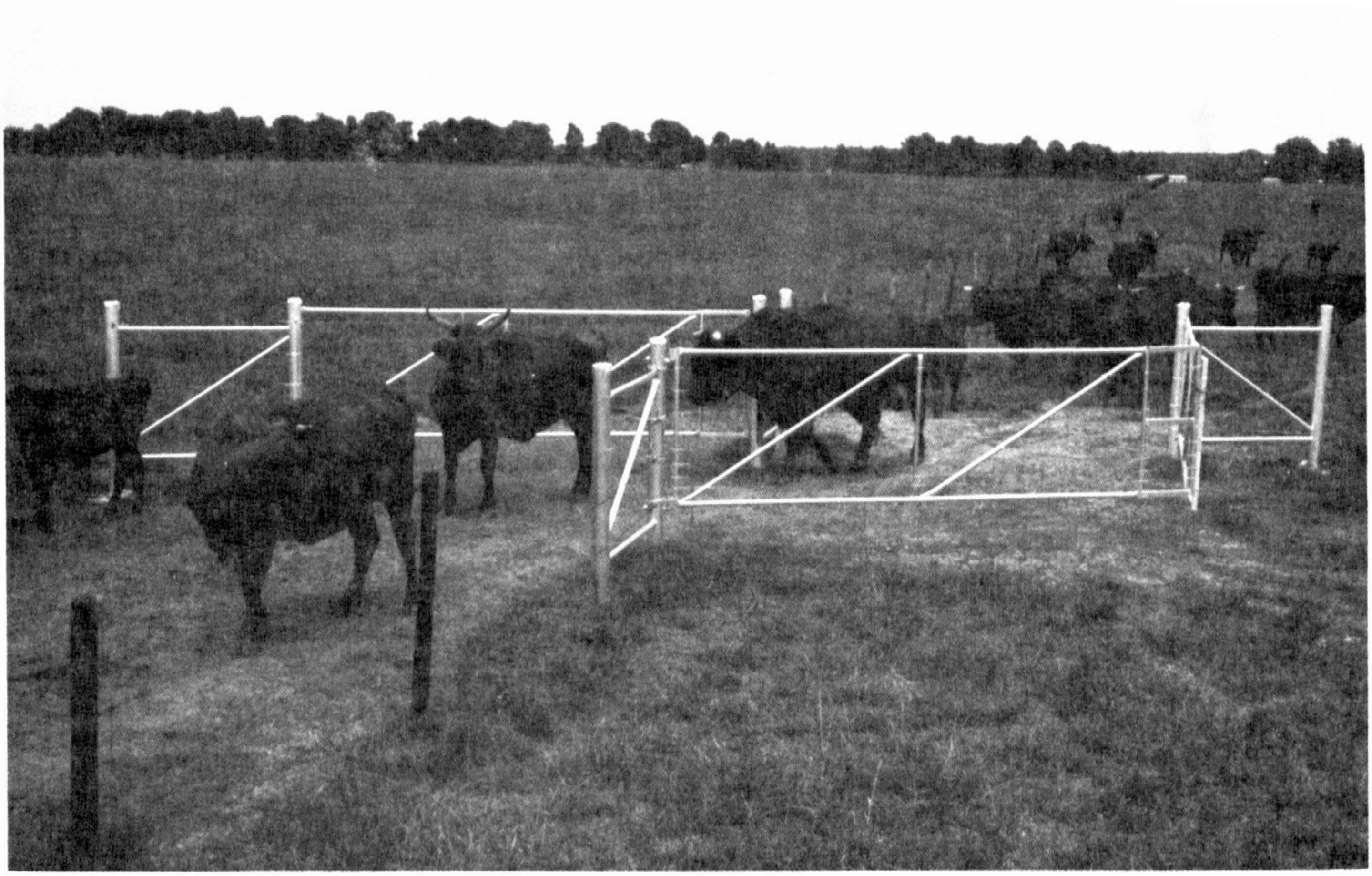


Figure 10.—Moving cattle from one pasture to another on Wiergate clay, 1 to 5 percent slopes. Rotation grazing permits plants to regain vigor.

pasture rotation, weed control, timely deferment of grazing, and restricted use during wet and dry periods help to keep vegetation and soil in good condition. Overgrazing or grazing when the soil is too dry or too wet causes surface compaction, excessive surface runoff, poor soil tilth, and lower vegetative quality.

This soil is moderately suited to pines and hardwoods. Wetness and the high clay content of this soil are moderate limitations for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is poorly suited to most urban uses. The very high shrink-swell potential, low strength, and wetness are the main limitations. When saturated, this soil does not have sufficient strength and stability to support vehicular traffic, but the wetness limitation can be partly corrected by strengthening or replacing the base material. The very slow permeability of this soil is a limitation for septic tank absorption fields, but the limitation can be partly overcome by the use of or the installation of other filtering and disposal systems, such as a central treatment plant.

Because of very slow permeability, clayey texture, and wetness, this soil is poorly suited to recreational uses.

This Wiergate soil is in land capability subclass IVe and in woodland ordination group 4c2.

WgC—Wiergate clay, 5 to 8 percent slopes. This is a sloping soil on convex, upland side slopes. Individual areas are elongated to irregular in shape and range from 25 to about 1,600 acres. The average slope is about 6 percent.

Typically, this soil has a very dark gray clay surface layer about 12 inches thick. The subsoil, to a depth of about 36 inches, is an olive gray clay. The next layer, to a depth of 60 inches, is pale olive clay. Reaction is mildly alkaline in the surface layer and moderately alkaline and calcareous in the subsoil.

Figure 11.—A mixture of oats, hairy vetch, and singletary peas provides winter pasture, soil improvement, and erosion control on Wiergate clay, 1 to 5 percent slopes.

This soil is somewhat poorly drained. Runoff is medium. The available water capacity is high, and permeability is very slow. A perched water table is within 2 feet of the surface during the winter. The erosion hazard is severe.

Included with this soil in mapping are small areas of Burkeville and Woodville soils. These included soils are in similar positions on the landscape as Wiergate soil. Also included are a few areas of soils that are similar to Wiergate soil, but they are noncalcareous. Also included are some soils in eroded or gullied areas. These included soils make up about 35 percent of the map unit.

Most areas of this Wiergate soil are used as pastureland. The remaining acreage is used as hayland or woodland.

The use of the soil for pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, weed control, timely deferment of grazing, and restricted use during wet and dry periods help to keep vegetation and soil in good condition. Overgrazing or grazing when soil is too dry or too wet causes surface compaction, excessive surface runoff, poor soil tilth, and lower vegetative quality.

This soil is moderately suited to pines and hardwoods. Wetness and the high clay content of this soil are moderate limitations for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is poorly suited to most urban uses. The very high shrink-swell potential, low strength, and wetness are the main limitations. When saturated, this soil does not have sufficient strength and stability to support vehicular traffic, but the limitation can be partly corrected by strengthening or replacing the base material. The very slow permeability of this soil is a limitation for septic tank absorption fields, but the limitation can be overcome by the use of or the installation of other filtering and disposal systems, such as a central treatment plant.

Because of very slow permeability, clayey texture, and wetness, this soil is poorly suited to recreational uses. Slope is a limitation for some recreational uses.

This Wiergate soil is in land capability subclass VIe and in woodland ordination group 4c2.

WoB—Woodville fine sandy loam, 1 to 5 percent slopes. This is a gently sloping soil on convex, upland slopes. Individual areas are irregular in shape and range from 10 to about 1,400 acres. The average slope is about 3 percent.

Typically, this soil has a fine sandy loam surface layer about 6 inches thick. It is brown in the upper part of the surface layer and pale brown in the lower part. The subsoil, to a depth of 70 inches, is clay. It is mottled brown and red in the upper part and light gray in the lower part. Reaction is medium acid in the surface layer, strongly acid or very strongly acid to a depth of about 65 inches, and moderately alkaline in the lower part of the subsoil.

This soil is somewhat poorly drained. Runoff is slow. The available water capacity is high, and permeability is very slow. A seasonal water table is at a depth of 2.5 to 4 feet during the winter. The surface layer is friable and is difficult to till throughout a narrow range of moisture content. The surface crusts or puddles after heavy rains if the plow layer contains subsoil material. Root development is restricted below the surface layer because of compaction and high clay content of the subsoil. The erosion hazard is severe.

Included with this soil in mapping are small areas of Burkeville, Moswell, Pinetucky, and Wiergate soils. These included soils are in similar positions on the landscape as Woodville soil. Also included are areas of Woodville soils, but they are more sloping. These included soils make up about 30 percent of the map unit.

Most areas of this Woodville soil are used as woodland (fig. 12). The remaining acreage is used as hayland or pastureland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use

Figure 12.—Pine logs are being stacked following cutting on Woodville fine sandy loam, 1 to 5 percent slopes.

during wet periods help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too wet causes compaction and poor soil tilth and increases runoff.

This soil is moderately suited to pine trees. Wetness and the high clay content are moderate limitations for planting or harvesting trees. If the site is prepared adequately and the competing vegetation and grazing are controlled, most seedlings survive and grow. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is poorly suited to most urban uses. The high shrink-swell potential, low strength, and wetness are the main limitations. When saturated, this soil does not have sufficient strength and stability to support vehicular traffic, but the wetness limitation can be corrected by strengthening or replacing the base material. The very slow permeability of this soil is a limitation to use as septic tank absorption fields, but the limitation can be overcome by installing a central sewage treatment plant.

Because of very slow permeability, this soil is poorly suited to recreational uses.

This Woodville soil is in land capability subclass IVe and in woodland ordination group 2c8.

WoD—Woodville fine sandy loam, 5 to 12 percent slopes. This is a sloping to strongly sloping soil on convex side slopes on uplands. Individual areas are irregular in shape and range from 10 to about 1,500 acres. The average slope is about 8 percent.

Typically, this soil has a brown fine sandy loam surface layer about 5 inches thick. The subsoil, to a depth of 65 inches, is a mottled brown and red clay in the upper part and a light brownish gray clay in the lower part. Reaction is medium acid in the surface layer. It is strongly acid in the upper part of the subsoil and medium acid in the lower part.

This soil is somewhat poorly drained. Runoff is medium. The available water capacity is high, and permeability is very slow. A water table is at a depth of 2.5 to 4 feet during the winter. The surface layer is friable and provides a suitable natural seedbed. Root development is restricted below the surface layer because of compaction and high clay content of the subsoil. The erosion hazard is severe.

Included with this soil in mapping are small areas of the Bonwier, Burkeville, Moswell, Pinetucky, Stringtown, and Wiergate soils. These included soils are in similar positions on the landscape as Woodville soil. Also included are areas of Woodville soils that have slopes less than 5 percent and more than 12 percent. These included soils make up about 35 percent of the map unit.

Most areas of this Woodville soil are used as woodland. The remaining acreage is used as hayland or pastureland.

The use of this soil as pastureland or hayland is effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the vegetation and soil in good condition. Overgrazing or grazing when the soil is too wet causes compaction and poor soil tilth and increases runoff.

This soil is moderately suited to pine trees. Wetness, high clay content, and slope are moderate limitations for planting or harvesting trees. If the site is prepared adequately and the competing vegetation is controlled, most seedlings survive and grow well. Recommended management practices include proper spacing, prescribed burning, and timber stand improvement.

This soil is poorly suited to most urban uses. High shrink-swell potential, low strength, slope, and wetness are the main limitations. When saturated, this soil does not have sufficient strength and stability to support vehicular traffic, but the wetness limitation can be corrected by strengthening or replacing the base material. The very slow permeability rate of this soil is a limitation to use as septic tank absorption fields, but the limitation can be overcome by installing a central sewage treatment plant.

Because of very slow permeability, this soil is poorly suited to most recreational uses. Slope is a limitation for some recreational uses.

This Woodville soil is in land capability subclass VIe and in woodland ordination group 2c8.

Prime Farmland

In this section, prime farmland is defined and discussed, and the prime farmland soils in Polk and San Jacinto Counties are listed in table 5.

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to producing food, feed, forage, fiber, and oilseed crops. Such soils have properties that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. The moisture supply, of course, must be adequate, and the growing season has to be sufficiently long. Prime farmland soils produce the highest yields with minimal inputs of energy and economic resources. Farming these soils results in the least damage to the environment.

Prime farmland soils may presently be in use as cropland, pasture, or woodland, or they may be in other uses. They either are used for producing food or fiber or are available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland. Urban or built-up land is any contiguous unit of land 10 acres or more in size that is used for such purposes as housing, industrial, and commercial sites, sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water control structures. Public land is land not available for farming in national forests, national parks, military reservations, and state parks.

Prime farmland soils usually get an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity level of the soils is acceptable. The soils have few or no rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not subject to frequent flooding during the growing season. The slope ranges mainly from 0 to 5 percent.

The soils that make up prime farmland in Polk and San Jacinto Counties are listed in table 5. The location of each map unit is shown on the detailed soil maps at the back of this publication. The extent of each unit is given in table 4. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

Soils that have limitations, such as a high water table or flooding, may qualify as prime farmland if these limitations are overcome by such measures as drainage or flood control. The measures needed to overcome the limitations of a map unit, if any, are shown in parentheses after the map unit name in table 5. Onsite evaluation is necessary to determine if the limitations have been overcome by the corrective measures.

About 416,900 acres in Polk and San Jacinto Counties, or about 38 percent of the total acreage, meet the requirements for prime farmland. Areas are scattered throughout the survey area. General soil map units 1, 2, 3, 8, 9, and 15 have the largest areas of prime farmland, general soil map units 11 and 14 have substantial areas, and general soil map units 4, 5, 6, 7, 10, 12, and 13 have only small scattered areas. Approximately 2,500 acres of these soils are used for cultivated crops. Crops, mainly soybeans, corn, and vegetables, account for an estimated one-tenth of the survey area's total agricultural income each year.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent

Figure 13.—A good pasture for cattle on Pinetucky fine sandy loam, 1 to 5 percent slopes.

construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern that is in harmony with nature.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Livestock grazing is an important aspect of agriculture in the survey area (fig. 13). According to statistics *(18)* about 48,000 head of cattle were in the survey area. Cattle operations are mainly cow-calf. Grazing lands have increased from about 61,000 acres in 1958 to about 245,000 acres in 1980. This includes improved pasture, hayland, and native pastureland. Most of the land that is presently used for livestock grazing was once used for cotton and corn production or was previously used as woodland. Vast areas of land used for timber production also have the potential of being used for some livestock grazing, but most of these areas are not presently being used for grazing.

The principal grasses grown in the survey area on improved pastures and hay meadows are coastal bermudagrass, alicia bermudagrass, common bermudagrass, and Pensacola bahiagrass. Most operators overseed these perennial pastures with a legume, such as hairy vetch, crimson clover, arrowleaf clover, or white dutch clover. These legumes provide additional winter grazing along with a substantial boost of nitrogen to the soil. Small grains, such as rye, wheat, and oats, are often planted singly or with a legume for fall and winter forage production.

Areas of pasture that were formerly in timber are usually characterized by soils that tend to have good surface drainage and have either fine sandy loam or loamy fine sand surfaces. This soil condition makes deep-rooted grasses, such as coastal and alicia bermudagrass, well adapted to the soil.

Not all land used for pastures have sandy or loamy surfaces. A significant amount of pastureland is on blackland soils, such as Burkeville, Garner, and Wiergate soils that are clayey throughout. In previous years, many areas of these soils were used for crop production. When these soils were used as cropland on sloping land, soil erosion was difficult to control. This often resulted in the loss of topsoil or in extensive gully erosion. This greatly increases the difficulty to establish a suitable grass cover for pastures. The common pasture grasses on these soils are Pensacola bahiagrass, dallisgrass, common bermudagrass and, to a smaller extent, coastal bermudagrass.

Pasture management is necessary to keep pasture productive. Typical management practices include brush and weed control, fertilization, and rotational grazing. Lime applications are needed on most areas every 3 to 4 years on the sandy and loamy surfaced soils to keep the soil neutral to slightly acid because they are naturally too acid for good pasture.

In recent years, smutgrass has become a nuisance in many parts of the survey area. This grass causes a general decline in pasture quality. The best method of control appears to be with chemicals. However, repeated applications of chemical herbicides are usually needed for complete control.

The acreage in cultivated crops in 1980 was about 2,500 acres compared to 27,000 acres in 1968. Most areas that were lost to crop production were put into improved pastures. The acreage of soybeans, although small, has increased over the past 10 years, while the acreage of cotton, corn, and grain sorghum has decreased.

The soils and climate of the survey area are suited to most crops that are commonly grown on the Gulf Coast and in East Texas and are suited to some crops that are not grown in the area, such as sugar cane, wheat, and oats.

The soils in the survey area are well suited to crops if the cropland acreage is increased. A large part of the 50,000 acres on the flatwoods that are now in woodland has the potential for cropland. Crop production could also be increased by extending the latest crop production technology to all cropland in the survey area. This soil survey can help facilitate the application of such technology.

The deep, well drained soils that warm early in the spring are also well suited to many vegetables and small fruits. Most well drained soils in the survey area are also suited to orchards and nursery plants. Soils in low areas where drainage is poor and the water table is near the

surface are poorly suited to early vegetables, small fruits, and orchards.

Most arable soils in the county respond well to nitrate, phosphate, and potash fertilizers. The soils are strongly acid to mildly alkaline. Acid soils generally need applications of lime to raise their pH sufficiently for good growth of pasture grasses and cereal crops and for other crops that grow well only on slightly acid or neutral soils. On all soils the amount of lime and fertilizer used should be based on the results of soil tests, on the needs of the crop, and on the expected yield. The local offices of the Extension Service and the Soil Conservation Service will help to determine the kind and amount of fertilizer and lime to apply.

Organic matter is an important source of nitrogen for crops. It also helps increase the water intake rate, reduce surface crusting, reduce soil losses from erosion, and promote good tilth. Most soils in the survey area that are used for growing crops have a surface layer of fine sandy loam or loam. Many of these soils have a low content of organic matter in the surface layer and generally have weak structure. Intensive rainfall causes the surface layer to crust. The crusting surface is hard when dry and can significantly decrease infiltration; therefore, runoff increases. Regularly adding manure and other organic material and returning crop residues to the soil help improve soil structure and reduce crust formation. Leaving crop residue on the surface also helps to prevent crust formation.

Soil erosion is a major hazard on about 50 percent of the cropland in Polk and San Jacinto Counties. Soil erosion reduces the productivity of the soil. If the surface layer is lost through erosion, so are most of the available plant nutrients. Most of the organic material, which has a positive effect on structure, water infiltration, available moisture capacity, and general tilth, is also lost. Controlling erosion not only helps to maintain crop production but also reduces downstream sedimentation and improves the quality of water downstream for municipal uses and for fish and wildlife.

Soils that have a clayey subsoil, such as Woodville, Wiergate, Garner, and Oakhurst soils, especially need protection against erosion. Preparing a good seedbed and tilling are difficult in the clayey spots that remain after the original friable surface layer has eroded away. Such spots are common in areas of Wiergate soils.

Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps plant cover on the soil for extended periods reduces soil erosion and preserves the productive capacity of the soils. Use of legume and grass forage crops in the cropping system reduces erosion on sloping land, provides nitrogen to plants, and improves soil tilth for the crop that follows. Other erosion control practices include minimum tillage, terraces, diversions, contouring, and cropping systems that rotate grass or close-growing crops with row crops.

Minimum tillage for soybeans and other row crops should increase as acres used for cultivated crops increase in Polk and San Jacinto Counties. Minimum tillage is effective in reducing erosion on sloping soils and can be used on most soils in the survey area.

Terraces and contour tillage reduce the length of slopes and thereby reduce runoff and erosion. They are most practical on deep soils that have uniform slopes. Leaving crop residue on the surface, either by minimum tillage or by stubble-mulching, helps to increase infiltration and reduces runoff and erosion. The extra cover is needed to help prevent erosion during seeding and early crop growth.

Diversions are effective in areas where significant water enters a field from the upper side. Diverting this outside water safely around the field reduces runoff in the fields.

Excess surface water is a major problem on some soils that are, or could be, used for cropland or pastureland. The Waller, Sorter, and Splendora soils are naturally wet enough to significantly effect their use for good crop and pasture production, and artificial drainage is required for maximum production.

The design of surface drainage systems varies with the kind of soil. An adequate outlet is often lacking and is needed in most areas of the poorly drained soils that are used intensively for row crops. Drains need to be more closely spaced on slowly permeable soils than on the more permeable soils.

Yields Per Acre

The average yields per acre that can be expected of the principal pasture crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various pasture crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding varieties; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the pasture crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for use as cropland. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major, and generally expensive, landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode, but they have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w,* or *s* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless a close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); and *s* shows that the soil is limited mainly because it is shallow, droughty, or stony.

There are no subclasses in class I because the soils of this class have few limitations. The soils in class V are subject to little or no erosion, but they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation. Class V contains only the subclasses indicated by *w* or *s*.

The capability classification of each map unit is given in the section "Detailed Soil Map Units."

Woodland Management and Productivity

Sandra Thorne-Brown, forester, Soil Conservation Service, Houston assisted in preparing this section.

Virgin forest once covered the southern two-thirds of the land in Polk and San Jacinto Counties. The northern third was savannah, woodland, and native pasture. Trees have been cleared for improved pastures and cultivation, and parts of the savannah have been planted to trees. Today, woodland covers approximately 855,000 acres or about 77 percent of the survey area. The Sam Houston National Forest covers 55,600 acres of San Jacinto County and the Big Thicket National Preserve covers 16,500 acres of Polk County. Timber companies own 543,800 acres, or about 67 percent of the privately owned woodland.

In 1980, the timber industries included three large sawmills, seven small sawmills, two veneer (plywood) plants, and a pine seedling nursery.

Pine forests cover about 66 percent of the woodland area, pine-hardwood covers about 16 percent, and mixed hardwood bottom land forests cover about 18 percent.

The principal upland forest types in this survey area are loblolly pine- shortleaf pine and pine-hardwood. Shortleaf pine predominates on droughty ridges such as the areas of Betis soils, and loblolly pine is most prevalent on other sites. Upland hardwoods are mainly sweetgum, southern red oak, water oak, willow oak, ash, blackgum, post oak, white oak, and hickory.

The bottom lands are such a mixture of hardwoods that it is difficult to divide them into distinct forest types. However, two general forest types are in these bottom lands. The sweetgum-water oak forest type includes willow, Nuttall, and laurel oaks. On wetter sites, the bald cypress-mixed hardwood forest type includes bald cypress, swamp tupelo, water elm, red maple, and water hickory.

The forests can be further divided into size classes. Sawtimber, which includes trees 10 inches or more in diameter, is about 64 percent of the standing tree volume. Poletimber, which includes trees from 5 to 10 inches in diameter, some of which are also used for pulpwood, make up 20 percent of the area's timber volume. Saplings and seedlings make up the remaining 16 percent.

Much of the woodland is understocked, and poor quality hardwoods are encroaching on highly productive pine sites. This mainly is because of the continuous logging of pine with little or no provision for pine regeneration. With proper management, prescribed burning can be used to control encroaching hardwoods.

The search for new energy sources has focused more attention on the possible utilization of inferior or undesirable hardwoods and heavy understory vegetation. Good woodland management generally includes a program of prescribed burning and mechanical and chemical weeding to control undesirable trees and shrubs.

The method used in managing timber is influenced by landowner goals and objectives, current timber markets, and size and condition of the tree stand.

Most small woodland tracts are harvested using the selection method. Large and mature trees are harvested in groups or individually, and dense stands of trees are thinned out in the same operation. This results in an unevenly aged stand. Regeneration of these stands comes from natural seeding in the small openings that were created from the cut. The selective harvest is generally repeated every 5 to 10 years depending on site productivity.

Large woodland tracts are generally harvested using the clearcut method. An entire stand of trees is harvested and the site prepared for planting by disposing of slash and by controlling the remaining vegetation with fire, chemicals, or mechanical equipment. If possible, the land is replanted in the same year. Use of genetically improved seedlings helps produce a higher quality and faster growing crop of trees. Direct seeding, where pine seeds are broadcast over the site, is rarely used today because the resulting stands are generally not uniform and are excessively closely spaced.

The clearcut method is most commonly used on land owned by pulp and paper companies where trees are generally harvested by age 30. In a 30-year rotation, about a thirtieth of the tract is clearcut in large parcels and replanted each year. In this way companies have continuous production of evenly aged stands.

The seed-tree method of harvesting is also used in this area. This method is similar to the clearcut method, but approximately 10 seed trees of good vigor and quality are left per acre when the harvest cut is made. These trees provide seed for the new stand of trees. The seed-tree method is well suited to areas that are often inaccessible and difficult to manage intensively. In most cases, these are excessively wet areas that can only be harvested during very dry years.

Wildlife benefits from a well managed woodland. Leaving at least 10 percent of the area in mast-producing trees, such as oaks and hickories, lowers the chance of a crop failure for wildlife food. Inaccessible and fragile areas, such as creek bottoms, steep slopes, and wetlands, may be best left in a natural state for wildlife. Maintaining a natural buffer at least 100 feet wide on each side of streams not only provides a good corridor for wildlife but the water quality will be protected from silt and sediment that is generated during logging operations. Prescribed burning and harvesting trees in large groups or individually allows more sunlight to reach the forest floor. This increases growth of succulent grasses and forbs for wildlife.

A foundation for woodland management plans and decisions comes from soil information. Intensive management of timber is most economical on soils that give a good return on the large investment in labor, machinery, and materials.

Soils influence the selection of management operations, their timing, and the type of equipment used to carry out the operations. Excessively wet, unstable, or very sandy soils must be recognized and provisions made to overcome the limitations they impose on such things as location and construction of access roads, site preparation, tree planting, and harvesting operations.

Special attention should be placed on woodland management in areas that are included in general soil map units 3, 6, 12, and 13. Included are soils, such as Diboll and Colita. The reasons are not fully understood, but a chemical or physical soil property can cause reduced stands or complete failures when establishing new stands following harvesting operations. This appears to be more severe in clearcut areas. Affected areas may show up as having a high seedling mortality or young trees may slowly self thin later. Practices that seem to be helpful in preventing or reducing this problem include very good seedbed preparation and planting techniques, planting as soon as possible after harvesting, and planting early in the growing season.

Rapid increases in timber prices, productive soils, and the ability to grow trees on short rotations have made tree farming in the southern United States profitable and gives an added incentive for intensive woodland management.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol (woodland suitability) for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *w* indicates excessive water in or on the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; and *s*, sandy texture. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: w, d, c, and s. The

third part of the symbol, a number, indicates the kind of trees best adapted to the soil. Numbers 1, 2, and 3 are for pines; 4, 5, and 6 are for hardwoods; and 7, 8, and 9 indicate that pines and hardwoods are equally adapted. A forth part of the symbol, rarely used, is a letter used to subdivide the woodland suitability based on the understory vegetation.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in a well-managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade where there are openings in the tree canopy. The invading plants compete with native plants or planted seedlings. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* indicates that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed to control undesirable plants.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index.* This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. Site index was determined at age 30 for eastern cottonwood and 50 years for all other species. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

Woodland Understory Vegetation

Understory vegetation consists of grasses, forbs, shrubs, and other plants. Woodland, if well managed, will produce enough understory vegetation to support grazing of livestock or wildlife, or both, without damage to the trees.

According to statistics *(18)*, in 1983 about 48,000 cattle were in the survey area. Livestock farming is still a major agricultural enterprise in Polk and San Jacinto Counties. The cattle operations are mainly cow-calf with the major part of the forage needs supplied by improved pastures. Many farmers have woodlands that are grazed and that contribute to the forage needs of their livestock; however, very few woodlands are managed to increase forage production or quality. Also, some cattlemen lease timber company lands or United States Department of Agriculture, Forest Service, lands for their cattle. About 100,000 acres of forest land is grazed in the area.

The density of the overstory canopy determines the amount of light that understory plants receive and is the major factor affecting the production of vegetation within reach of livestock and large game animals. Good silvicultural practices, such as the thinning of timber stands, removal of cull trees, controlled burning, and proper stocking, are necessary to maintain moderate to good production. Without proper management practices, the canopy increases drastically because of the growth of shrubs and hardwoods in the midstory.

Forage production increases after the clearcutting of an area. Herbage yields average about 1,500 pounds (air dry) per acre annually and on choice sites can exceed 3,000 pounds. On grazed woodland that is periodically burned, grasses make up about 80 percent of the understory vegetation, and sedges, forbs, and shrubs make up the rest.

A site that has a closed canopy of 75 percent or more may not have sufficient carrying capacity for a profitable livestock operation, and use of the area by big game animals will be limited because of the lack of browse plants.

In 1983, hunting leases were worth about eight times the value of grazing leases on an acre basis. Since livestock and deer compete for many of the same browse plants in woodlands, very good livestock management is necessary to minimize the reduction in carrying capacity of the woodlands for deer. Many landowners are removing livestock from their woodlands in favor of deer herds.

The quantity and quality of understory vegetation vary with the kind of soil, the age and kind of trees in the

canopy, and the depth and condition of the litter on the forest floor.

Table 8 lists the major plants (grasses, forbs, shrubs, and understory reproduction) that may be present under the canopy density which represents the highest wood production for the forest crop of the particular woodland ordination group. The understory vegetation includes the herbaceous plants and the leaves, twigs, and fruit of woody plants up to a height of 4-1/2 feet. The annual production is expressed in pounds per acre of air-dry vegetation expected in normal years receiving average soil moisture during the growing season.

Table 8 also lists the vegetation common to the woodland ordination group by percent composition (air-dry weight) for each plant. The table shows the kind and percentage of understory plants expected that may occur in the plant community where burning has occurred every 3 of 4 years and the overstory canopy is 36 to 55 percent, and it is composed mostly of pine.

The following practices, in addition to proper woodland management, are designed to help the land user achieve high levels of forage production consistent with good forest management:

Proper woodland grazing or *Proper grazing use* is grazing at an intensity that maintains or improves the quantity and quality of desirable plants. This is generally thought to be grazing of no more than one-half, by weight, of the annual growth of key forage plants in preferred grazing areas. This increases vigor and reproduction of these key forage plants, conserves soil and water, improves the condition of the vegetation, increases forage production, maintains natural beauty, and reduces the hazard of wildfire.

Deferred grazing is postponing grazing or resting a site from grazing for a prescribed period. This rest period promotes the growth of natural vegetation by increasing the vigor of forage and permitting desirable plants to seed. Deferred grazing provides feed reserves for fall and winter grazing, improves the appearance of lands that have adequate cover, improves hydrologic conditions, and reduces soil loss.

Planned grazing systems are systems in which two or more grazing units are rested from grazing in a planned sequence throughout the year or during the growing season of key forage plants. This is advantageous for the production of desirable forage plants and for trees.

Prescribed burning involves the use of controlled fire. This can be used to control undesirable vegetation, to remove old, unpalatable, rough growth, to increase production through removal of part of the duff; and to reduce the hazard of wildfires.

Recreation

Polk and San Jacinto Counties have many areas of scenic, geologic, and historic interest. These areas are used for camping, hiking, hunting, fishing, sightseeing, picnicking, and boating. Public areas available for recreation include the Sam Houston National Forest, Big Thicket National Preserve, Alabama-Coushatta Indian Reservation and Wolf Creek Park, Tigerville Park, and Lake Livingston State Recreation Area.

Use of recreation facilities in the survey area has greatly increased in the past several years. Many soils are moderately suited to development of recreation facilities.

In table 9, the soils of the survey area are rated according to the limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have gentle slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes,

stones, or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Polk and San Jacinto Counties have large and varied populations of animals, birds, and fish. White-tailed deer, raccoons, squirrels, turkeys, and rabbits inhabit the woodland areas (fig. 14). The pastureland and cropland areas provide food and cover for the quail, raccoon, egrets, dove, many types of songbirds, and cottontail rabbits. The streams and lakes support catfish, crappie, and bass. Beaver, alligator and opossum are common in other areas. The lakes and wetlands also provide resting and feeding areas for migratory waterfowl in fall and spring.

Many areas in these counties can be improved for use as wildlife habitat by increasing the food and water supply and providing cover for the wildlife.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn and soybeans.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, clover, and bermudagrass.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, and paspalums.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, sweetgum, hawthorn, dogwood, hickory, blackberry, and blueberry.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, cedar, and baldcypress.

Figure 14.—This area of Choates loamy fine sand, 1 to 5 percent slopes, provides good habitat for wildlife.

Wetland plants are annual and perennial, wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, swamps, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, herons, shore birds, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations must be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to: evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding and shrink-swell potential can cause the movement of footings. A high water table, depth to bedrock, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally

limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost-action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand or clay in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 12 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and that good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Large stones and bedrock interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope and bedrock can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper

trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or

soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and releases a variety of plant-available nutrients as it decomposes.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives the restrictive features that affect each soil for drainage and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; and susceptibility to flooding. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20, or higher, for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The

estimates are based on test data from the survey area, or from nearby areas, and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate, or component, consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They influence the soil's absorbption of cations, moisture retention, shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage in each major soil layer is stated in inches of water per inch of soil. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE)

to predict the average annual rate of soil loss by sheet and rill erosion. Losses are expressed in tons per acre per year. These estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur over a sustained period without affecting crop productivity. The rate is expressed in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflowing streams, by runoff from adjacent slopes, or by inflow from high tides. Shallow water standing or flowing for short periods after rainfall is not considered flooding. Standing water in swamps and marshes or in a closed depression is considered ponding.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely to occur.

Frequency, duration, and probable dates of occurrence are estimated. Frequency generally is expressed as *none, rare,* or *frequent. None* means that flooding is not probable. *Rare* means that flooding is unlikely but possible under unusual weather conditions (there is a near 0 to 5 percent chance of flooding in any year). *Frequent* means that flooding occurs often under normal weather conditions (there is more than a 50 percent chance of flooding in any year). Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 days to 1 month), and *very long* (more than 1 month). The time of year that floods are most likely to occur is expressed in months. November-May, for example, means that flooding can occur during the period November through May. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding is based on evidence in the soil profile, namely, thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons, which are characteristic of soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table, that is, *perched, artesian*, or *apparent;* and the months of the year that the water table commonly is highest. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated

zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

The two numbers in the "High water table-Depth" column indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that the water table exists for less than a month.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severely corrosive environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and the amount of sulfates in the saturation extract.

Engineering Index Test Data

Table 18 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil Series and Their Morphology." The soil samples were tested by the Texas State Department of Highways and Public transportation.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM); Shrinkage—T 92 (AASHTO), D 427 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(20)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or on laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Ultisol.

SUBORDER. Each order is divided into suborders, primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udult (*Ud*, meaning humid, plus *ult*, from Ultisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludults (*Hapl*, meaning minimal horizonation, plus *udult*, the suborder of the Ultisols that have an udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludults.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, siliceous, thermic Typic Haplaquents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. There can be some variation in the texture of the surface layer or of the substratum within a series. An example is the Stringtown series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (19)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (20)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Bernaldo Series

The Bernaldo series consists of deep, well drained, moderately permeable soils on terraces and erosional uplands. They formed in unconsolidated acid, loamy sediment. Slope ranges from 0 to 8 percent.

Typical pedon of Bernaldo fine sandy loam, 0 to 3 percent slopes; from the intersection of U.S. Highway 59 and Farm Road 1127 about 13 miles south of Livingston 3.2 miles east on Farm Road 1127, 50 feet north, and 50 feet east; in a pasture:

A—0 to 4 inches; dark grayish brown (10YR 4/2) fine sandy loam; very weak medium and fine granular structure; soft, very friable; common medium and many fine roots; slightly acid; clear smooth boundary.

E—4 to 19 inches; yellowish brown (10YR 5/4) loamy very fine sand; very weak medium angular blocky structure and very weak medium granular structure; loose; common fine and medium roots; slightly acid; abrupt wavy boundary.

Bt1—19 to 29 inches; yellowish red (5YR 4/6) clay loam; few coarse faint reddish yellow mottles; moderate medium angular and subangular blocky structure; very hard, firm; common fine roots; patchy clay film on faces of peds and in pores; few clay flows in cracks; slightly acid; gradual smooth boundary.

Bt2—29 to 35 inches; strong brown (7.5YR 4/6) clay loam; few coarse faint reddish yellow mottles; moderate medium angular and subangular blocky structure; very hard, firm; common fine roots; few clay coatings on sand grains; patchy clay film on faces of peds and in pores; medium acid; gradual smooth boundary.

Bt3—35 to 41 inches; strong brown (7.5YR 5/6) loam; few medium and coarse faint reddish yellow mottles; moderate medium subangular blocky structure; hard, firm; few fine roots; clay coating on sand grains; medium acid; clear boundary.

Bt/E1—41 to 57 inches; reddish yellow (7.5YR 6/6) loam (Bt), about 25 percent, by volume, light yellowish brown (10YR 6/4) fine sandy loam (E); weak medium subangular blocky structure and weak medium granular structure; soft, very friable; few fine roots; few clay coatings on sand grains; strongly acid; clear boundary.

Bt/E2—57 to 63 inches; strong brown (7.5YR 5/6) loam; weak medium subangular blocky structure and weak medium granular structure; slightly hard, very friable; few fine roots; pockets and interfingers of cleaned sand grains; slightly acid; gradual boundary.

Bt/E3—63 to 71 inches; strong brown (7.5YR 5/6) loam; many medium and coarse prominent dark grayish brown (10YR 4/2) and common medium distinct yellowish red (5YR 5/8) mottles; moderate medium subangular blocky structure and moderate medium granular structure; slightly hard, very friable; few fine roots; few pockets of cleaned sand grains; strongly acid; clear wavy boundary.

2C—71 to 80 inches; very pale brown (10YR 8/4) sand; single grained, loose; few fine roots; strongly acid.

The thickness of the solum is more than 60 inches.

The A horizon is dark grayish brown, brown, and dark yellowish brown. It ranges from 3 to 6 inches thick. Reaction is strongly acid to slightly acid.

The E horizon is light yellowish brown, yellowish brown, and brown. It ranges from 10 to 17 inches thick. Texture is loamy very fine sand or fine sandy loam.

The Bt horizon is yellowish red, reddish brown, yellowish brown, and strong brown. Mottles in shades of red and brown are in most pedons. Texture of the Bt horizon is loam, clay loam, or sandy clay loam. Reaction is strongly acid to slightly acid. The Bt/E horizon consists of Bt material that contains interfingers and ped coatings of bleached or cleaned sand E material. The Bt/E horizon is reddish yellow, strong brown, brown, light yellowish brown, or very pale brown. Texture is loam or fine sandy loam. The lower part of the Bt/E horizon is distinctly mottled in most pedons. Reaction is strongly acid to slightly acid.

The 2C horizon is variable in texture. Texture ranges from sand to loamy sand. The horizon is absent in some pedons. If present, it is at a depth of 60 inches or more.

Betis Series

The Betis series consists of deep, somewhat excessively drained, rapidly permeable soils on broad interstream divides in the Coastal Plain. They formed in thick sandy sediment. Slope ranges from 1 to 5 percent.

Typical pedon of Betis loamy fine sand, 1 to 5 percent slopes; from intersection of U.S. Highway 190 and Texas Highway 146 in Livingston, 14.5 miles east on U.S. Highway 190, 0.8 mile north, and 100 feet east; in a woodland:

A—0 to 6 inches; dark grayish brown (10YR 4/2) loamy fine sand; weak fine granular structure; soft, very friable; many medium and coarse roots; very strongly acid; clear smooth boundary.

E1—6 to 9 inches; yellowish brown (10YR 5/4) loamy fine sand; common coarse faint brown (10YR 5/3) mottles; single grained; soft, very friable; many medium and coarse roots; very strongly acid; gradual smooth boundary.

E2—9 to 24 inches; dark yellowish brown (10YR 4/4) loamy fine sand; few coarse faint brown mottles; single grained; loose; many fine and medium roots; very strongly acid; gradual smooth boundary.

Bw—24 to 36 inches; yellowish red (5YR 5/6) loamy fine sand; common small bodies of very pale brown (10YR 7/3) sand; single grained; soft, very friable; few fine and medium roots; strongly acid; gradual smooth boundary.

Bt1—36 to 60 inches; yellowish red (5YR 5/6) loamy fine sand; common small bodies of very pale brown (10YR 7/3) sand; moderate medium granular structure; soft, very friable; few medium and coarse roots; clay bridged and coated sand grains; strongly acid; gradual smooth boundary.

Bt2—60 to 76 inches; strong brown (7.5YR 5/6) loamy fine sand; yellowish brown (10YR 5/6) fine sandy

loam lamellae 1 inch to 1.5 inches thick; single grained; massive lamellae; soft, very friable; clay bridged lamellae; strongly acid; gradual smooth boundary.

BC—76 to 80 inches; reddish yellow (7.5YR 6/6) fine sand; common coarse faint very pale brown (10YR 7/4) mottles; single grained; few fine roots; strongly acid.

The thickness of the solum is more than 60 inches. Reaction ranges from very strongly acid to medium acid throughout.

The A horizon is dark grayish brown to grayish brown, grayish brown, or brown. It ranges from 4 to 12 inches thick. The darker colored A horizons are less than 7 inches thick. The E horizon is dark yellowish brown, brown, or yellowish brown. It ranges from 8 to 30 inches thick. The combined thickness of the A and E horizons ranges from 20 to 35 inches.

The Bw horizon is strong brown, yellowish brown, and yellowish red. Randomly distributed pockets of cleaned sand grains are few or common. The Bt horizon is strong brown, yellowish brown, and yellowish red. The Bt horizon is loamy fine sand throughout or is loamy fine sand to fine sand and has lamella bands of a slightly finer material that are 1/2 inch to 2 1/2 inches thick. The BC horizon is fine sand or loamy fine sand.

Bienville Series

The Bienville series consists of deep, somewhat excessively drained, moderately rapidly permeable soils on stream terraces in the Coastal Plain. They formed in sandy alluvial sediment. Slope ranges from 0 to 3 percent.

Typical pedon of Bienville loamy fine sand, 0 to 3 percent slopes; from intersection of U.S. Highway 59 and Farm Road 223 in Shepherd, 5 miles southeast on Farm Road 223, 1.1 miles north on subdivision entrance road, 0.9 mile east to Big Creek on Center Street to Frances Avenue, and 50 feet northeast from intersection:

A—0 to 6 inches; dark yellowish brown (10YR 4/4) loamy fine sand; very fine granular structure; loose, very friable; many fine roots; slightly acid; clear smooth boundary.

E—6 to 24 inches; dark yellowish brown (10YR 4/4) loamy fine sand; single grained; loose, very friable; many fine and medium roots; 1/4 inch wide horizontal bands of cleaned sand grains, slightly acid; clear wavy boundary.

B/E—24 to 65 inches; brown (7.5YR 4/4) loamy fine sand; single grained; loose, very friable; many fine roots; discontinuous spots and streaks of clay coating and bridging of sand grains (Bt) in lower part; slightly acid; gradual wavy boundary.

Bt—65 to 80 inches; brown (7.5YR 4/4) loamy fine sand; many medium and coarse distinct strong brown (7.5YR 5/6) mottles; very weak medium subangular blocky structure; loose, very friable; few fine roots; common sand grains coated and bridged with clay; few medium and thick lamellae of finer material; medium acid.

The thickness of the solum is more than 60 inches.

The A horizon is grayish brown, dark grayish brown, brown, dark brown, or very dark grayish brown. It is 4 to 12 inches thick. The darker colored A horizons are less than 7 inches thick. Reaction is medium acid or slightly acid. This horizon is 4 to 12 inches thick. The E horizon is dark grayish brown, brown, or yellowish brown. It is 10 to 30 inches thick. Reaction ranges from strongly acid to slightly acid. The combined thickness of the A and E horizons is 16 to 35 inches.

The B horizon is brown, strong brown, or yellowish brown. It is loamy fine sand or fine sand, that has sand grains bridged with clay and lamella bands of a slightly finer material that are 1/2 inch to 2 1/4 inches thick. Reaction ranges from very strongly acid to slightly acid.

Bonwier Series

The Bonwier series consists of deep, well drained, moderately slowly permeable soils on side slopes on uplands. They formed in stratified, acid, loamy and clayey sediment. Slope ranges from 5 to 12 percent.

Typical pedon of Bonwier fine sandy loam, in an area of Stringtown-Bonwier association, strongly sloping; from the U.S. Post Office in Dallardsville on Farm Road 1276, 4.5 miles northeast on gravel road, 0.1 mile southeast, and 200 feet north; in a woodland:

A—0 to 5 inches; dark brown (10YR 3/3) fine sandy loam; weak fine subangular blocky and granular structure; soft, very friable; many very fine and fine roots; few coarse gravel; strongly acid; clear smooth boundary.

E—5 to 9 inches; yellowish brown (10YR 5/4) fine sandy loam; weak fine granular structure; soft, very friable; many very fine and fine roots; common coarse gravel; strongly acid; abrupt smooth boundary.

Bt1—9 to 15 inches; yellowish red (5YR 5/6) sandy clay; weak fine subangular blocky structure; hard, very firm; common very fine roots; few fine pores; few medium gravel; clay film on faces of peds; very strongly acid; clear wavy boundary.

Bt2—15 to 26 inches; strong brown (7.5YR 5/8) sandy clay; common medium prominent dark red (2.5YR 3/6) and common fine and medium prominent red (2.5YR 4/6) mottles; weak fine subangular blocky and granular structure; slightly hard, firm; few very fine roots; few very fine pores; common fine gravel; clay film on faces of peds; very strongly acid; clear wavy boundary.

C—26 to 40 inches; yellowish red (5YR 5/6) soft sandstone; common fine distinct dark red (2.5YR 3/6) and common medium distinct yellowish brown (10YR 5/6) mottles; massive; slightly hard, firm; few very fine roots; common fine and medium gravel; very strongly acid.

The thickness of the solum ranges from 20 to 40 inches.

The A horizon is dark grayish brown, brown, dark brown, and dark yellowish brown. It is 3 to 7 inches thick. Reaction ranges from very strongly acid to medium acid. Texture is fine sandy loam or sandy loam.

The E horizon is brown, pale brown, yellowish brown, and light yellowish brown. It is 4 to 6 inches thick. Reaction ranges from very strongly acid to medium acid.

The Bt horizon is yellowish red, reddish brown, or red. The lower part of the Bt horizon is yellowish red and strong brown. Texture is clay or sandy clay but ranges to sandy clay loam in the lower part of some pedons. Reaction is very strongly acid or strongly acid.

The C horizon is variable in color and texture, but commonly is layered in shades of red, brown, and gray soft sandstone and clay.

Boykin Series

The Boykin series consists of deep, well drained, moderately permeable soils on uplands in the Coastal Plain. They formed in unconsolidated, sandy and loamy marine and fluvial deposits. Slope ranges from 1 to 5 percent.

Typical pedon of Boykin loamy fine sand, 1 to 5 percent slopes; from the intersection of U.S. Highway 190 and Texas Highway 146 in Livingston, 11 miles southeast on Texas Highway 146, 9.5 miles east on Farm Road 943, 1.7 miles south, 4,800 feet west, and 1,300 feet north:

A1—0 to 4 inches; grayish brown (10YR 5/2) loamy fine sand; weak medium granular structure; loose, very friable; many coarse roots; some cleaned sand grains; medium acid; gradual wavy boundary.

A2—4 to 8 inches; brown (10YR 5/3) loamy fine sand; weak medium granular structure; loose, very friable; many coarse tree roots; many worm casts and pores; medium acid; gradual wavy boundary.

E—8 to 22 inches; pinkish gray (7.5YR 6/2) loamy fine sand; weak fine granular structure; loose, very friable; many fine and medium roots; strongly acid; gradual smooth boundary.

Bt1—22 to 35 inches; yellowish red (5YR 4/8) fine sandy loam; few medium distinct brown (7.5YR 5/2) mottles; weak medium subangular blocky structure; slightly hard, very friable; many fine roots; few sand grains coated and bridged with clay; strongly acid; diffuse smooth boundary.

Bt2—35 to 70 inches; red (2.5YR 4/8) sandy clay loam; few fine and medium faint brown mottles; moderate medium subangular blocky structure; slightly hard, friable; few fine roots; thin discontinuous clay film on vertical and horizontal faces of peds; clay content gradually decreases below 60 inches; strongly acid.

The thickness of the solum is more than 60 inches.

The A horizon is grayish brown, brown, dark brown, or dark grayish brown. It is 4 to 12 inches thick. Reaction is strongly acid or medium acid. The E horizon is grayish brown, brown, yellowish brown, pale brown, light yellowish brown, pinkish gray, or light brown. It is 10 to 30 inches thick. Reaction is strongly acid or medium acid. Combined thickness of the A and E horizons ranges from 22 to 40 inches.

The B horizon ranges from yellowish red to red. Texture is fine sandy loam or sandy clay loam. The content of clay in the B horizon typically is 20 to 30 percent but ranges from 15 to 35 percent. Reaction is very strongly acid or strongly acid.

Burkeville Series

The Burkeville series consists of deep, somewhat poorly drained, very slowly permeable soils on eroded uplands. They formed in weakly consolidated, calcareous, clayey sediment that is high in montmorillonitic clay. Slope ranges from 5 to 15 percent.

Typical pedon of Burkeville clay, 5 to 15 percent slopes; from the intersection of U.S. Highway 190 and Texas Highway 156 near Point Blank, 0.3 mile east on Texas Highway 156, 0.5 mile south on Texas Highway 156, 1.1 miles west to the west side of McGee Creek, and 400 feet north:

A—0 to 5 inches; grayish brown (2.5Y 5/2) clay; moderate medium granular structure; extremely hard, very firm; many fine roots; few fine strongly cemented concretions of calcium carbonate; moderately alkaline; calcareous; gradual smooth boundary.

AC1—5 to 30 inches; light brownish gray (2.5Y 6/2) clay; few fine distinct yellowish brown mottles; moderate medium granular structure; extremely hard, very firm; few fine roots; few slickensides; few fine strongly cemented concretions of calcium carbonate; moderately alkaline; clear smooth boundary.

AC2—30 to 60 inches; pale olive (5Y 6/3) clay; common medium distinct mottles of olive yellow (2.5Y 6/8); moderate medium blocky structure; extremely hard, very firm; many large intersecting slickensides; distinct parallelepipeds having axes tilted 20 to 45 degrees from the horizontal; few medium strongly cemented concretions of calcium carbonate; moderately alkaline; calcareous.

The thickness of the solum is more than 40 inches over calcareous clay and marl. Texture is clay throughout. Because of past erosion, Gilgai or other external features of churning properties are not present or these properties are minimal. Depth to intersecting slickensides ranges from 3 to 20 inches. Vertical streaks of a darker material or of old filled cracks are few or common. These soils are moderately alkaline and calcareous.

The A horizon is dark grayish brown, grayish brown, gray, dark gray, or very dark gray. It is 1 to 15 inches thick. If the color values of this horizon are less than 3.5, the thickness is less than 12 inches. The AC horizon is light yellowish brown, light brownish gray, light gray, light olive gray, pale olive, or pale yellow. This horizon has few to common mottles of reddish gray, olive yellow, and light yellowish brown.

Choates Series

The Choates series consists of deep, somewhat poorly drained, moderately slowly permeable soils on uplands in the Coastal Plain. They formed in sandy and loamy sediment of marine origin. Slope ranges from 1 to 5 percent.

Typical pedon of Choates loamy fine sand, 1 to 5 percent slopes; from the intersection of U.S. Highway 190 and Farm Road 2500, 5.2 miles north on Farm Road 2500, 0.7 mile southeast on county road to stream channel, 50 feet north, and 50 feet west of stream channel; in a forest:

A—0 to 2 inches; grayish brown (10YR 5/2) loamy fine sand; single grained; loose; common fine roots; strongly acid; clear smooth boundary.

E1—2 to 11 inches; light yellowish brown (10YR 6/4) loamy fine sand; few fine faint light gray and common medium faint very pale brown (10YR 7/3) mottles; single grained; loose; common fine roots; medium acid; gradual smooth boundary.

E2—11 to 24 inches; very pale brown (10YR 7/3) loamy fine sand, common fine faint light gray (10YR 7/2) and light yellowish brown (10YR 6/4) mottles and common fine distinct light gray (10YR 7/1) mottles; single grained; loose; few fine roots; medium acid; clear smooth boundary.

Bt1—24 to 30 inches; strong brown (7.5YR 5/8) sandy clay loam; common fine faint yellowish red (5YR 5/6), common fine distinct light gray (10YR 7/1) and few fine and medium prominent red (10R 4/6) mottles; weak medium subangular blocky structure; slightly hard, friable; thin clay film on faces of peds; very strongly acid; clear smooth boundary.

Bt2—30 to 42 inches; reddish yellow (7.5YR 6/6) sand clay loam; many medium faint strong brown (7.5YR 5/8) and brownish yellow (10YR 6/6) mottles, common fine distinct light gray (10YR 7/2), common medium prominent red (10R 4/8) mottles; slightly hard, very friable; few fine roots; thin clay film on faces of peds; few nodules of plinthite; very strongly acid; gradual smooth boundary.

Btv1—42 to 48 inches; coarsely mottled very pale brown (10YR 7/4) and reddish yellow (7.5YR 6/6) sandy clay loam; common medium distinct yellow (10YR 7/6), common fine prominent light gray (10YR 7/1) and common coarse prominent red (2.5YR 4/6) mottles; weak coarse subangular blocky structure; slightly hard, very friable; few fine roots; clay film on faces of peds; about 8 percent plinthite; few rounded quartz gravel up to 5 millimeters in size; very strongly acid; clear smooth boundary.

Btv2—48 to 58 inches; coarsely mottled very pale brown (10YR 7/4) and reddish yellow (7.5YR 6/6) sandy clay loam; common medium distinct yellow (10YR 7/6), common fine prominent light gray (10YR 7/1) and common medium prominent white (10YR 8/1) mottles; weak coarse subangular blocky structure; slightly hard, very friable; clay film on faces of peds; about 5 percent plinthite; very strongly acid; gradual smooth boundary.

BC—58 to 80 inches; coarsely mottled white (10YR 8/1) and yellow (10YR 7/6) sandy loam; common medium prominent red (10YR 4/6, 2.5YR 4/6) and common fine distinct brownish yellow (10YR 6/6) mottles; weak coarse subangular blocky structure; slightly hard, friable; very strongly acid.

The thickness of the solum ranges from 65 to more than 80 inches. Plinthite, by volume, ranges from 5 to 20 percent in the lower part of the Bt horizon. Base saturation at a depth of 50 inches below the surface of the Bt horizon ranges from 15 to 35 percent. Reaction ranges from strongly acid through slightly acid in the A and E horizons and from extremely acid through strongly acid in the Bt horizon.

The A horizon is grayish brown, dark grayish brown, very dark grayish brown, brown, or dark brown. It is 1 to 12 inches thick.

The E horizon is light gray, light brownish gray, grayish brown, very pale brown, pale brown, brown, light yellowish brown, pinkish gray, or light brown. It is 8 to 35 inches thick.

The Bt horizon is yellowish red, strong brown, reddish yellow, yellowish brown, red, or brownish yellow fine sandy loam or sandy clay loam. The upper part of the Bt horizon is mainly high chroma colors mottled with gray. The lower part has colors that are similar to those in the upper part of the Bt horizon, but has a higher percentage of grays and yellows or has a mottled matrix. The BC horizon is mainly gray, white, light gray, or light brownish gray and has mottles in shades of red and yellow. Some mottles are red and dark red.

Colita Series

The Colita series consists of deep, somewhat poorly drained, moderately permeable soils on uplands in the Coastal Plain. They formed in tuffaceous siltstone and shales, mainly of the Catahoula Formation. Slope ranges from 0 to 5 percent.

Typical pedon of Colita fine sandy loam, 0 to 3 percent slopes; from the intersection of U.S. Highway 59 and Farm Road 350 in Moscow, 10.5 miles west on Farm Road 350, 0.6 mile west to Colita, 2.2 miles north on dirt road, 2,000 feet northeast, and 100 feet east; in a woodland:

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) fine sandy loam; many medium faint yellow (10YR 7/6) mottles; weak medium granular structure; loose, very friable; many fine and medium roots; few black stains; very strongly acid; gradual boundary.

A2—5 to 11 inches; dark grayish brown (10YR 4/2) loamy very fine sand; few fine distinct strong brown (7.5YR 5/6) mottles; weak medium granular structure; loose; common fine and medium roots; many cleaned sand grains; many small pores; very strongly acid; gradual wavy boundary.

E/B—11 to 32 inches; light gray (10YR 7/2) very fine sandy loam (E); about 25 percent, by volume, vertically oriented streaks and masses of common medium prominent strong brown (7.5YR 5/6) mottles (B); massive; loose; few medium and coarse roots; very strongly acid; gradual wavy boundary.

Btg/E—32 to 40 inches; light gray (10YR 7/2) fine sandy loam; common medium prominent strong brown (7.5YR 5/6) mottles; about 30 percent, by volume, tongues and interfingering of light gray loamy very fine sand; weak medium subangular blocky structure; very hard, friable; thin patchy clay film on faces of peds; strongly acid; gradual wavy boundary.

Btg—40 to 45 inches; light gray (2.5Y 7/2) sandy clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; moderate medium blocky structure; extremely hard, firm; patchy clay film on faces of peds; few peds have thin coatings of cleaned sand grains; strongly acid; abrupt wavy boundary.

Cr—45 to 47 inches; pale olive (5Y 6/3) shale of silty clay loam; separates to platy and blocky fragments; extremely hard, very firm, and brittle.

The thickness of the solum and depth to paralithic contact range from 40 to 60 inches, and are typically about 45 inches. Base saturation at the paralithic contact ranges from 35 to 60 percent. The weighted average of clay content in the control section is about 24 percent, and the content of sand that is coarser than very fine sand is about 44 percent. The sodium absorption ratio is less than 10 throughout.

The A horizon is gray, dark gray, very dark gray, grayish brown, dark grayish brown, or very dark grayish brown. It is 7 to 20 inches thick. If values are less than 3.5, the thickness is less than 6 inches. Texture is fine sandy loam or loamy very fine sand. Reaction ranges from very strongly acid to medium acid.

The E part of the E/B horizon is gray, light gray, or light brownish gray. The B part has colors that are similar to those in the E part and has mottles in the ped interiors. The B part makes up about 10 to 40 percent, by volume, of the horizon. Reaction ranges from very strongly acid to medium acid. The thickness of this horizon ranges from 6 to 25 inches.

The Btg/E horizon is light gray, dark gray, gray, light brownish gray, grayish brown, or dark grayish brown. Mottles in shades of brown are common or many. The thickness of this horizon ranges from 4 to 10 inches. The texture is sandy clay loam or fine sandy loam. Penetration of albic materials (E) into the Btg/E horizon is mainly along vertical faces of peds. The penetrations are 2 millimeters to 30 millimeters wide and typically extend through the horizon. Filled crayfish burrows range from few to many. Reaction ranges from very strongly acid to medium acid. The Btg horizon is gray, light gray, grayish brown, or light brownish gray. It is 3 to 10 inches thick. Texture is sandy clay loam, clay loam, or silty clay loam. Reaction ranges from very strongly acid to medium acid.

The Cr horizon is light gray, light brownish gray, pale brown, very pale brown, light olive gray, pale olive, or pale yellow. It is firm, brittle siltstone or shale. Widely scattered deposits of calcium carbonate and other white salts are in fractures in some pedons.

Colita Variant

The Colita Variant consists of moderately deep, somewhat poorly drained, moderately permeable soils on uplands. They formed in weathered, tuffaceous siltstone and shales, mainly of the Catahoula Formation. Slope ranges from 1 to 8 percent.

Typical pedon of Colita Variant fine sandy loam, in an area of Colita Variant-Kitterll complex, 1 to 8 percent slopes; from intersection of U.S. Highway 59 and U.S. Highway 287 in Corrigan, 1.7 miles southeast on U.S. Highway 287, and 250 feet north; in a forest:

A1—0 to 3 inches; dark grayish brown (10YR 4/2) fine sandy loam; moderate medium subangular blocky structure; hard, friable, nonsticky and nonplastic; common fine and medium roots; very strongly acid; clear smooth boundary.

A2—3 to 7 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak medium subangular blocky structure; hard, friable, nonsticky and nonplastic; few fine roots; very strongly acid; clear smooth boundary.

E—7 to 11 inches; light brownish gray (10YR 6/2) fine sandy loam; weak medium subangular blocky structure; hard, friable, nonsticky and nonplastic; few fine roots; very strongly acid; clear smooth boundary.

Bt—11 to 18 inches; light brownish gray (10YR 6/2) sandy clay loam; common fine distinct brownish yellow (10YR 6/6) and few fine distinct yellowish brown (10YR 5/4) and gray (5Y 5/1) mottles; weak medium subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few fine roots; patchy clay film on faces of peds; very strongly acid, clear wavy boundary.

Cr—18 to 22 inches; light brownish gray (10YR 6/2) weakly consolidated sandstone of sandy clay loam; common fine and medium distinct brownish yellow (10YR 6/8) mottles; few fractures at about 1 foot intervals; separates to platy fragments with difficulty; very strongly acid.

The thickness of the solum and depth to paralithic contact range from 15 to 40 inches and are generally 18 to 30 inches. The content of clay in the control section ranges from 18 to 27 percent. The A horizon is grayish brown, dark grayish brown, or brown. Reaction ranges from very strongly acid to medium acid. The E horizon is light brownish gray, grayish brown, or pale brown. Mottles range from none to common in shades of brown, yellow or gray. Texture is fine sandy loam or loamy fine sand. Reaction ranges from very strongly acid to medium acid.

The combined thickness of the A and E horizon ranges from about 8 to 15 inches.

The Bt horizon is light brownish gray, grayish brown, or gray. Mottles range from none to common in shades of brown, yellow, or gray. Texture is loam or sandy clay loam. Some pedons, generally those with thicker sola, have penetrations of albic materials along faces of peds. Reaction ranges from very strongly acid to medium acid.

The Cr horizon is gray, dark gray, grayish brown, light brownish gray, or olive gray. It is weakly consolidated, tuffaceous sandstone or siltstone. In some pedons, white salts occur in fractures.

This soil is a variant to the Colita soil because the solum is thinner than 40 inches and because glossic features are not well expressed in the thinner pedons.

Conroe Series

The Conroe series consists of deep, moderately well drained, slowly permeable soils on ridges and divides in the southern Coastal Plain. They formed in unconsolidated, acid, sandy clay. Slope ranges from 1 to 8 percent.

Typical pedon of Conroe gravelly loamy fine sand, 1 to 5 percent slopes; from the intersection of Texas Highway 150 and Farm Road 1725, 15 miles west of Coldspring, 3.0 miles southeast on Farm Road 1725 to Farm Road 3081, 3.2 miles west, and 25 feet north:

Ac—0 to 5 inches; dark gray (10YR 4/1) gravelly loamy fine sand; single grained; loose, very friable; many medium and fine roots; about 15 percent, by volume, ironstone nodules up to 2 centimeters in diameter; very strongly acid; clear smooth boundary.

Ec—5 to 22 inches; light yellowish brown (10YR 6/4) gravelly loamy fine sand; single grained; loose; many medium roots; 50 percent, by volume, ironstone nodules up to 2 centimeters in diameter; very strongly acid; gradual wavy boundary.

Btc—22 to 26 inches; yellowish brown (10YR 5/6) sandy clay loam; common fine and medium distinct yellowish red (5YR 5/6) and red (2.5YR 5/6) mottles; moderate fine blocky structure; firm, hard; many medium and coarse roots; few fine pores; thin patchy clay film on some faces of peds; slightly cemented dark red (2.5YR 3/6) concretions in centers of some mottles; 20 percent, by volume, ironstone nodules; very strongly acid; gradual wavy boundary.

Btv1—26 to 48 inches; yellowish brown (10YR 5/4) sandy clay; many coarse and medium prominent red (2.5YR 4/8) and yellow (10YR 7/6) mottles; moderate medium blocky structure; extremely hard, firm, brittle; few medium and coarse roots in the yellowish brown areas; few fine pores; thick continuous clay film; 10 percent by volume, ironstone nodules; about 30 percent plinthite; red concretions in centers of some mottles; very strongly acid; gradual wavy boundary.

Btv2—48 to 60 inches; mottled light gray (10YR 7/2), light brownish gray (10YR 6/2) and brownish yellow (10YR 6/6) sandy clay; few medium prominent red (2.5YR 4/8) mottles; moderate coarse blocky structure parting to fine and medium blocky structure; extremely hard, firm, brittle; few fine roots in the light gray areas; few fine pores; few brown stains on faces of peds; thick continuous clay film; 8 percent, by volume, ironstone nodules; about 40 percent plinthite; very strongly acid.

The thickness of the solum ranges from 60 to more than 100 inches.

The A and E horizons are loamy fine sand, loamy sand, or their gravelly analogs. These horizons are 20 to 40 inches thick. Reaction ranges from slightly acid to very strongly acid. Ironstone nodules range from 5 to 50 percent, by volume, and these nodules typically are concentrated in the E horizon. The Ac horizon ranges from dark gray to light gray or pale brown. The Ec horizon ranges from gray or light gray to pale brown or light yellowish brown.

The Btc horizon is brownish yellow to yellowish brown and has red or yellowish red mottles. This horizon is 3 to

7 inches thick. Texture is sandy clay loam, sandy clay, or clay loam. Ironstone nodules range from few to 25 percent, by volume. Plinthite ranges from none to 10 percent by volume. Reaction is strongly acid or very strongly acid. The Btv horizon is sandy clay or clay. In this horizon, the clay content ranges from 35 to 50 percent and silt content is less than 20 percent. Ironstone nodules range from few to 15 percent, by volume. Reaction is strongly or very strongly acid. The Btv1 horizon is brownish yellow to yellowish brown and has common to many yellowish red, red, yellow, or dark red mottles. Plinthite ranges from 20 to 40 percent, by volume. The Btv2 horizon is mottled red, dark red, yellow, brownish yellow, strong brown and gray. Plinthite ranges from 35 to 50 percent, by volume.

Dallardsville Series

The Dallardsville series consists of deep, somewhat poorly drained, and moderately slowly permeable soils in level to slightly concave areas and incipient drainageways in the Coastal Plain. They formed in thick loamy sediment on marine terraces of Pleistocene age. Slope ranges from 0 to 2 percent.

Typical pedon of Dallardsville loamy very fine sand, 0 to 2 percent slopes; from intersection of Farm Road 1276 and Farm Road 943 southeast of Segno, 5.2 miles southeast of Farm Road 943, 1.1 miles south on dirt road, and 30 feet east; in a woodland:

A1—0 to 2 inches; grayish brown (2.5Y 5/2) loamy very fine sand; weak fine granular structure; soft, very friable; common fine and medium roots; many worm casts; very strongly acid; abrupt smooth boundary.

A2—2 to 5 inches; pale brown (10YR 6/3) loamy very fine sand; weak fine granular structure; loose, very friable; many fine roots; many worm casts; extremely acid; clear smooth boundary.

E—5 to 19 inches; very pale brown (10YR 7/3) loamy very fine sand; few fine faint yellow mottles; weak medium subangular blocky structure; soft, very friable; common fine and medium roots; common medium and fine pores; very strongly acid; gradual smooth boundary.

E/B—19 to 27 inches; light gray (10YR 7/2) loamy very fine sand (E); about 40 percent pale brown (10YR 6/3) very fine sandy loam containing common fine and medium distinct brownish yellow (10YR 6/6) mottles (B); weak coarse prismatic structure parting to weak medium subangular blocky structure; soft, very friable; few medium and fine roots; vertically oriented material (B) extending upward from horizon below, or isolated bodies (B) surrounded by E material; extremely acid; clear irregular boundary.

B/E—27 to 33 inches; light gray (10YR 7/2) very fine sandy loam (B); about 30 percent tongues of loamy very fine sand 5 to 10 millimeters wide (E); many fine distinct brownish yellow (10YR 6/6) mottles; in interior of peds; weak medium subangular blocky structure; slightly hard, very friable; few medium and fine roots; clay film on faces of peds; sand grains bridged and coated with clay; extremely acid; gradual wavy boundary.

Btg1—33 to 45 inches; light gray (10YR 6/1) loam; many medium and coarse distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; hard, friable; few roots; thin clay film on faces of peds; sand grains bridged and coated with clay; extremely acid; gradual wavy boundary.

Btg2—45 to 70 inches; light gray (2.5Y 6/1) clay loam; many medium and coarse distinct strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; very hard, firm; few fine roots; thin clay film on faces of peds; sand grains bridged and coated with clay; extremely acid.

The thickness of the solum is more than 60 inches. Reaction is extremely acid or very strongly acid.

The A horizon is grayish brown, brown, gray, light gray or very pale brown. The E horizon is brown, pale brown, very pale brown, or light yellowish brown. The combined thickness of the A and E horizons is 25 to 35 inches.

The combined thickness of the tongued E/B and B/E horizons ranges from 8 to 20 inches. These horizons are light gray, light brownish gray, brown, pale brown, very pale brown, and light yellowish brown.

The B horizon is light gray to light brownish gray. Texture is loam, sandy clay loam, or clay loam. This horizon has common medium or coarse distinct mottles of yellowish brown, brownish yellow or yellow.

Diboll Series

The Diboll series consists of deep, somewhat poorly drained, very slowly permeable soils on uplands. They formed in unconsolidated, acid, loamy sediment underlain by siltstone. Slope ranges from 0 to 3 percent.

Typical pedon of Diboll silt loam, 0 to 3 percent slopes; from the intersection of U.S. Highway 59 and Farm Road 357, 2.7 miles northwest on Farm Road 357, 2.8 miles south and west on forest road, and 20 feet north; in a woodland about 1,000 feet east of the Trinity and Polk county line:

A—0 to 5 inches; grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) silt loam; common fine faint yellow mottles; weak fine subangular blocky structure; soft, very friable; many very fine to coarse roots; many fine pores, few medium and coarse pores; few worm casts; very strongly acid; abrupt smooth boundary.

E—5 to 22 inches; light brownish gray (10YR 6/2) very fine sandy loam; weak fine subangular blocky and granular structure; soft, very friable; common very

fine to coarse roots; many very fine pores; very strongly acid; clear irregular boundary.

Btn/E—22 to 39 inches; grayish brown (10YR 5/2) silt loam; few fine faint dark brown mottles; common medium distinct light yellowish brown (2.5Y 6/4) mottles within peds; about 30 percent of the horizon tongues (E) of light brownish gray (10YR 6/2) very fine sandy loam; weak fine subangular blocky and granular structure; soft, very friable; common very fine to coarse roots; many very fine pores; very dark grayish brown and dark brown clay film on faces of peds; common white streaks of sand grains or salt inside of peds and along ped faces; common krotovina; very strongly acid; clear irregular boundary.

2Cr/Btn—39 to 45 inches; light yellowish brown (2.5Y 6/4) clay loam; few fine faint brownish yellow mottles; weak medium prismatic structure (Btn); fracture planes (Cr) coatings 2 to 5 millimeters thick of grayish brown (10YR 5/2) silty clay loam (Btn) and interfingers of light brownish gray (10YR 6/2) very fine sandy loam; hard, firm; few fine roots; about 50 percent of ped interior appears to be slightly weathered siltstone; few krotovina; few gypsum crystals; very strongly acid; gradual wavy boundary.

2Cr—45 to 60 inches; light yellowish brown (2.5Y 6/4) siltstone; few fine faint brownish yellow and yellowish brown mottles; massive; hard, firm; few fine roots; few gypsum crystals and white salts; few fine layered pieces of mudstone; slightly acid.

The thickness of the solum ranges from 30 to 50 inches. Depth to a paralithic contact of siltstone or mudstone is 40 to 60 inches.

The A horizon is grayish brown or dark grayish brown. It ranges from 3 to 12 inches thick. Reaction is very strongly acid to medium acid. Texture is very fine sandy loam, silt loam, or loam.

The E horizon is gray, light gray, light brownish gray, or grayish brown. It ranges from 9 to 34 inches thick. Texture is very fine sandy loam or loam. Reaction is very strongly acid through medium acid.

The combined thickness of the A and E horizons ranges from 20 to 45 inches.

The Btn/E horizon has variegated colors. The Btn part is streaks, masses, and thick coatings on pieces of siltstone. It is dark gray, very dark gray, gray, grayish brown, or dark grayish brown. Texture is loam, silt loam, silty clay loam, and clay loam. The E part consists of tongues, streaks, and krotovina of light brownish gray, grayish brown, or pale brown very fine sandy loam. Mottles in shades of brown or yellow range from none to common. Reaction is very strongly acid to neutral. Exchangeable sodium ranges from 18 to 25 percent. Electrical conductivity ranges from 1 to 6 millimhos per centimeter.

The Cr horizon is a grayish, olive or yellowish colored siltstone or mudstone. Gypsum crystals range from few to common.

Doucette Series

The Doucette series consists of deep, well drained, moderately permeable soils on uplands in the Coastal Plain. They formed in sandy and loamy sediment of Pleistocene age, mainly of the Willis Formation. Slope ranges from 1 to 5 percent.

Typical pedon of Doucette loamy fine sand, 1 to 5 percent slopes; from the intersection of U.S. Highway 59 and Farm Road 942 in Leggett, 4.6 miles east on Farm Road 942, 1.2 miles south, and 300 feet east:

A1—0 to 4 inches; dark grayish brown (10YR 4/2) loamy fine sand; weak medium granular structure; soft, very friable; many fine and medium roots; medium acid; clear boundary.

A2—4 to 6 inches; brown (10YR 4/3) loamy fine sand; weak medium granular structure; soft, very friable; common fine and medium roots; few coarse faint dark grayish brown mottles; strongly acid; gradual boundary.

E—6 to 22 inches; pale brown (10YR 6/4) loamy fine sand; common medium faint strong brown (7.5YR 5/6) mottles; weak medium granular structure; soft, very friable; fine roots, very strongly acid; clear wavy boundary.

Bt1—22 to 37 inches; strong brown (7.5YR 5/6) sandy clay loam; common fine prominent yellowish red (5YR 5/8) mottles; weak medium subangular blocky structure; hard, friable; few fine roots; patchy clay film on ped faces; few ironstone concretions; very strongly acid; gradual smooth boundary.

Btv1—37 to 55 inches; strong brown (7.5YR 5/6) sandy clay loam; common medium prominent yellowish red (5YR 5/8) mottles; moderate medium subangular blocky structure; slightly hard, friable; few medium roots; patchy clay film on faces of peds; about 5 percent plinthite, by volume; very strongly acid; gradual smooth boundary.

Btv2—55 to 70 inches; reticulately mottled strong brown (7.5YR 5/6) and yellowish red (5YR 4/6) and light brownish gray (10YR 6/2) sandy clay loam; weak medium subangular blocky structure; firm, brittle and hard local spots when moist; very few fine roots; brownish yellow clay film on some vertical ped surfaces; about 10 percent plinthite, by volume; very strongly acid.

The thickness of the solum is more than 60 inches. Depth to a horizon containing 5 to 20 percent plinthite ranges from 30 to 60 inches. Base saturation at 50 inches below the surface of the Bt horizon ranges from 5 to 25 percent.

The A horizon is dark grayish brown, dark brown, brown, pale brown, yellowish brown, or light yellowish brown. The E horizon is brown, pale brown, yellowish brown, or pale brown. The combined thickness of the A and E horizons ranges from 20 to 40 inches. Reaction is medium acid to very strongly acid.

The Bt horizon has color dominantly strong brown, brownish yellow or reddish yellow. Mottles in shades of red, yellow, and gray are in the lower part of most pedons. Plinthite ranges from 5 to 20 percent in some subhorizons. Reaction is strongly acid or very strongly acid.

Fausse Series

The Fausse series consist of very poorly drained and very slowly permeable soils in low, ponded, backswamp areas along the Trinity River. These soils formed in thick, clayey alluvium deposited by the Trinity River.

Typical pedon of Fausse clay, frequently flooded; from the intersection of U.S. Highway 59 and Farm Road 1127 north of Shepherd, 3 miles east on Farm Road 1127, and 65 feet south; in a cypress swamp in San Jacinto County:

O—1 to 0 inch; very dark grayish brown (10YR 3/2) muck; weak medium granular structure; hard, friable, sticky, slightly plastic; many roots and partially decayed woody material; strongly acid; clear smooth boundary.

A—0 to 8 inches; very dark grayish brown (10YR 3/2) clay; many fine and medium distinct strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; extremely hard, very firm, very sticky and very plastic; common roots of all sizes; few fine pores; medium acid; clear smooth boundary.

Bg1—8 to 20 inches; dark gray (10YR 4/1) clay; many fine and medium distinct strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few medium and coarse roots; neutral; gradual smooth boundary.

Bg2—20 to 35 inches; dark gray (10YR 4/1) clay; many fine, medium and coarse prominent yellowish red (5YR 5/8) mottles; weak fine subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few clean sand grains; few streaks of silt; neutral; clear smooth boundary.

Bg3—35 to 42 inches; dark gray (10YR 4/1) clay; many medium and coarse distinct yellowish brown (10YR 5/8) and few fine and medium prominent yellowish red (5YR 5/8) mottles; weak fine subangular blocky structure; extremely hard, very firm, very sticky and very plastic; very dark gray (10YR 3/1) spots, few clear sand and silt streaks; neutral; gradual smooth boundary.

Cg—42 to 60 inches; gray (5Y 5/1) clay; few medium and coarse distinct yellowish brown (10YR 5/8) and few fine and medium prominent yellowish red (5YR 5/8) mottles; massive; extremely hard, very firm, very sticky and very plastic; few very dark gray (10YR 3/1) and dark grayish brown (10YR 4/2) spots; stratification of white silt and silt loam material; slightly acid.

The thickness of the solum ranges from 30 to 50 inches. The soil is saturated or above field capacity in all layers below 24 inches in most years. Cracks do not form within 20 inches of the soil surface in most years.

The O horizon, if present, is very dark gray, dark gray, very dark grayish brown, black, or very dark brown. It is less than 4 inches thick. Texture is muck or mucky peat. Reaction ranges from very strongly acid to medium acid.

The A horizon is dark gray, very dark gray, very dark grayish brown, or dark grayish brown. It is 2 to 12 inches thick. Reaction ranges from medium acid to neutral.

The Bg horizon is gray, dark gray, greenish gray, or dark greenish gray. Reaction ranges from neutral through moderately alkaline.

The Cg horizon has colors that are similar to those in the Bg horizon. Texture is clay, silty clay, or silty clay loam. Some pedons have thin organic enriched strata. Reaction ranges from neutral through moderately alkaline.

Garner Series

The Garner series consists of deep, poorly drained, very slowly permeable soils on uplands and terraces. They formed in alkaline, clayey sediment. Slope ranges from 0 to 5 percent.

Typical pedon of Garner clay, 0 to 1 percent slopes; from the intersection of U.S. Highway 190 and Farm Road 350 about 2.2 miles west of Livingston, 3.5 miles southwest on Farm Road 350, and 150 feet south; in a pasture:

A—0 to 5 inches; dark gray (10YR 4/1) clay; moderate fine blocky structure; very hard, firm; many fine roots; few fine pores, slightly acid; gradual wavy boundary.

Bg—5 to 26 inches; gray (10YR 6/1) clay; many fine and medium distinct yellowish brown (10YR 5/4) and reddish yellow (5YR 6/6) mottles; moderate medium blocky structure; few parallelepipeds having their long axes tilted about 20 degrees from the horizontal; few slickensides; extremely hard, very firm; shiny pressure faces on peds; few fine weakly cemented black concretions and bodies; slightly acid; diffuse wavy boundary.

BCg—26 to 65 inches; gray (5Y 6/1) clay; many fine and medium distinct yellowish brown (10YR 5/4) and pale yellow (2.5YR 7/4) mottles; many intersecting slickensides; distinct parallelepipeds having their long axes tilted about 20 to 45 degrees from the

horizontal; extremely hard, very firm; few fine strongly cemented concretions of calcium carbonate and crystals of gypsum below 56 inches; few fine weakly cemented black concretions; neutral.

Depth to intersecting slickensides ranges from about 20 to 30 inches below the soil surface. Gilgai relief consists of knolls 3 to 10 feet in diameter and 3 to 10 inches higher than the depressions. Length of cycles of microknolls and microlows range from 8 to 16 feet. Soil areas are about 70 percent microlows and 30 percent microknolls. The amplitude of waviness of the boundary between the A and Bg horizons is 6 to 15 inches. The solum is very dark gray, dark gray, gray, or light gray. Less than 30 percent of the pedon has value of 3.5 or less to a depth of more than 12 inches.

The A horizon ranges from about 2 inches thick on some microknolls to as much as 35 inches in some microlows. Some pedons have an A horizon that has few to common, fine to medium, faint to distinct grayish, brownish, or yellowish mottles. Reaction is medium acid to mildly alkaline.

The Bg horizon contains few to many mottles in shades of brown, yellow, and red. Few to common vertical streaks of A horizon material that are 1/4 to 1 inch wide are evident in some pedons. Reaction is medium acid to moderately alkaline. The Bg and BCg horizons contain 50 to 60 percent clay with few to common black concretions. The BCg horizon is gray or light gray with few to many mottles in shades of brown, yellow, or olive.

Hatliff Series

The Hatliff series consists of deep, moderately well drained, moderately rapidly permeable soils on flood plains. They formed in deep, loamy and sandy alluvial sediment. Slope ranges from 0 to 2 percent but is mostly less than 1 percent.

Typical pedon of Hatliff loam, frequently flooded; from intersection of Farm Road 943 and Farm Road 2798 at Segno, 0.8 mile west on Farm Road 943, 0.4 mile south on private road, and 900 feet east on flood plain of Menard Creek:

A1—0 to 5 inches; dark brown (10YR 4/3) loam; few fine faint dark gray mottles; common fine distinct strong brown stains in root channels and on ped surfaces; weak fine subangular blocky structure; hard, friable; common fine and medium roots; few worm casts; medium acid; abrupt smooth boundary.

A2—5 to 11 inches; brown (10YR 5/3) fine sandy loam; common fine faint dark gray and common fine distinct strong brown mottles; few strong brown stains in root channels; weak fine subangular blocky structure; hard, friable; common fine and medium roots; strongly acid; abrupt smooth boundary.

C1—11 to 29 inches; yellowish brown (10YR 5/4) fine sandy loam; few medium distinct strong brown (7.5YR 5/8) and few fine faint light brownish gray mottles; few strong brown stains in root channels; common strata 1 to 5 centimeters thick light yellowish brown (10YR 6/4) loamy fine sand; bedding planes evident; massive; very friable; strongly acid; abrupt smooth boundary.

C2—29 to 38 inches; very pale brown (10YR 7/4) loamy fine sand; few fine faint brownish yellow mottles; few strata 5 to 10 millimeters in thick brown (10YR 5/3) fine sandy loam; single grained; loose; very friable; medium acid; abrupt smooth boundary.

C3—38 to 70 inches; very pale brown (10YR 7/4) loamy fine sand; common strata 1 to 3 centimeters thick light brownish gray (10YR 6/2) fine sandy loam; fine sandy loam strata contain few fine distinct yellowish brown (10YR 5/6) mottles and strong brown stains in root channels; single grained; very friable; slightly acid; abrupt smooth boundary.

C4—70 to 80 inches; very pale brown (10YR 7/4) sand; common fine distinct brownish yellow (10YR 6/6) mottles; single grained; loose; neutral.

Soil reaction ranges from strongly acid to neutral but is medium acid to neutral in some parts of the control section. Bedding planes are evident, and strata of contrasting textures occur throughout the soil. Low chroma mottles in shades of gray are within 20 inches of the surface. Clay content in the 10- to 40-inch control section ranges from 8 to 18 percent.

The A horizon is dark gray, gray, very dark grayish brown, dark grayish brown, grayish brown, light brownish gray, dark brown, brown, or pale brown. It is 6 to 14 inches thick. If color is very dark grayish brown, thickness is less than 7 inches. Mottles in shades of gray, brown, or yellow range from none to common. Reaction is strongly acid to neutral.

The C horizon is grayish brown, light brownish gray, light gray, brown, pale brown, very pale brown, yellowish brown, or light yellowish brown. Texture is fine sandy loam, sandy loam, loamy fine sand, fine sand, or sand. In some pedons the C horizon below a depth of 40 inches has matrix colors of gray.

Herty Series

The Herty series consists of deep, somewhat poorly drained, very slowly permeable soils on uplands. They formed in acid, clayey shale. Slope ranges from 1 to 5 percent.

Typical pedon of Herty silt loam, 1 to 3 percent slopes; from the intersection of Farm Road 357 and U.S. Highway 59, 4.1 miles west on Farm Road 357, 1 mile north on dirt road, and 15 feet west; in a woodland:

A—0 to 2 inches; dark brown (10YR 3/3) silt loam; weak very fine and fine subangular blocky structure; slightly hard, very friable; many medium to coarse roots; few fine pores; very strongly acid; abrupt smooth boundary.

Bt1—2 to 13 inches; dark grayish brown (10YR 4/2) silty clay; few fine distinct yellowish red (5YR 5/8) mottles; moderate fine subangular blocky structure; extremely hard, very firm; many fine to coarse roots; few fine pores; few organic stains along root channels; patchy clay film along faces of peds; few coarse fragments; few fine mudstone fragments; extremely acid; clear smooth boundary.

Bt2—13 to 39 inches; dark grayish brown (10YR 4/2) silty clay; moderate fine angular blocky structure; extremely hard, very firm; common fine roots; common fine pores; patchy clay film along faces of peds; many fine pieces of mudstone; few fine flakes of gypsum; extremely acid; clear smooth boundary.

B/Cy—39 to 46 inches; dark yellowish brown (10YR 4/4) silty clay; few medium distinct dark yellowish brown (10YR 4/6) mottles; few fine faint dark gray mottles; moderate medium subangular and angular blocky structure; extremely hard, very firm; few fine roots; few fine pores; patchy clay film along ped surfaces; many fine fragments of mudstone; common gypsum crystals; extremely acid; clear smooth boundary.

Cy—46 to 60 inches; dark grayish brown (10YR 4/2) clayey shale; common fine distinct dark yellowish brown (10YR 4/6) mottles; massive; extremely hard, very firm; common gypsum crystals; extremely acid.

The thickness of the solum ranges from 40 to 60 inches.

The A horizon is dark grayish brown, grayish brown, dark brown, or brown. It ranges from 2 to 10 inches thick.

The upper part of the Bt horizon is dark grayish brown, grayish brown, light brownish gray, dark gray, or gray. Red, yellowish red, or strong brown mottles range from few to common. Reaction ranges from strongly acid to extremely acid. Texture is silty clay, silty clay loam or clay. The lower part of the Bt and B/C horizons has colors that are similar to those in the upper part of the Bt horizon, and, in addition, also includes olive gray, olive, dark yellowish brown, brown, and dark brown. Gypsum crystals range from few to many. Reaction is very strongly acid to extremely acid. Salinity ranges from low to moderate.

The C horizon is clayey shale or weakly consolidated mudstone in colors of gray, olive and brown. Gypsum ranges from a few crystals up to 25 percent, by volume.

Kaman Series

The Kaman series consists of deep, poorly drained, very slowly permeable soils on flood plains that are associated with the Coastal Plain. They formed in recent alkaline, clayey sediment. Slope ranges from 0 to 2 percent.

Typical pedon of Kaman clay, frequently flooded; from the intersection of U.S. Highway 59 and Farm Road 223 in Shepherd, 500 feet north on U.S. Highway 59, 2.5 miles east on dirt road, and 50 feet north; in a pasture:

A1—0 to 5 inches; black (10YR 2/1) clay; moderate fine subangular blocky and granular structure; extremely hard, very firm; many fine roots; slightly acid; gradual smooth boundary.

A2—5 to 28 inches; black (10YR 2/1) clay; moderate coarse blocky structure parting to moderate fine blocky and subangular blocky structure; extremely hard, very firm; common fine roots; shiny pressure faces on some ped faces; slightly acid; diffuse wavy boundary.

A3—28 to 40 inches; black (10YR 2/1) clay; moderate medium and fine blocky structure; extremely hard, very firm; few fine roots concentrated along cracks and ped faces; shiny pressure faces on ped faces; few slickensides; few fine black concretions; slightly acid; diffuse wavy boundary.

Bg1—40 to 55 inches; dark gray (10YR 4/1) clay; common fine distinct strong brown and yellowish brown mottles; weak and moderate medium blocky structure; extremely hard, very firm; few roots in cracks; common intersecting slickensides; common parallelepipeds that have long axes tilted about 40 degrees from the horizontal; few fine black concretions; medium acid; diffuse wavy boundary.

Bg2—55 to 72 inches; dark gray (10YR 4/1) clay; common fine distinct strong brown and yellowish brown mottles; massive; extremely hard, very firm; few slickensides; few fine concretions of calcium carbonate; few fine black masses; mildly alkaline.

The A horizon is black to very dark gray clay or silty clay. Mottles range from none to common in shades of yellow and brown. The A horizon ranges from 24 to 60 inches thick. Depth to intersecting slickensides ranges from 10 to 36 inches below the surface. Overwash deposits of loamy material are adjacent to stream channels in some places. The overwash deposits are less than 10 inches thick. The clay content ranges from 40 to 60 percent. Reaction ranges from slightly acid to mildly alkaline.

The Bg horizon ranges from gray to very dark gray. In some pedons, this horizon has common mottles of yellow, brown and olive. Texture ranges from clay to silty clay. In some places are strata of coarser materials. Reaction is mildly alkaline to medium acid. Concretions of calcium carbonate range from none to few below 40 inches.

A Cg horizon that is similar to the Bg horizon occurs in some pedons.

Keltys Series

The Keltys series consists of deep, moderately well drained, slowly permeable soils on uplands. They formed in unconsolidated, acid, loamy sediment. Slope ranges from 1 to 5 percent.

Typical pedon of Keltys very fine sandy loam, 1 to 5 percent slopes; from the intersection of U.S. Highway 59 and Farm Road 375, 2.7 miles northwest on Farm Road 357, 1.8 miles south and west on forest road, and 5 feet south of road; in a woodland about 300 feet west of road intersection:

A—0 to 5 inches; dark brown (10YR 4/3) very fine sandy loam; weak fine subangular blocky structure; soft, very friable; many very fine and coarse roots; few fine pores; strongly acid; clear smooth boundary.

E1—5 to 19 inches; pale brown (10YR 6/3) very fine sandy loam; weak fine subangular blocky structure; soft, very friable; many very fine and coarse roots; few fine pores; medium acid; clear smooth boundary.

E2—19 to 29 inches; pale brown (10YR 6/3) very fine sandy loam; few fine faint light brownish gray mottles; weak fine subangular blocky structure; soft, very friable; common very fine and coarse roots; few fine pores; few gravel 10 to 20 millimeters in size; medium acid; clear smooth boundary.

Bt/E1—29 to 34 inches; grayish brown (10YR 5/2) fine sandy loam; few fine faint yellowish brown mottles; pale brown (10YR 6/3) very fine sandy loam about 30 percent of the horizon (E); weak fine and medium subangular blocky structure; soft, very friable; many very fine and coarse roots; common fine pores; some patchy clay bridges; strongly acid; clear smooth boundary.

Bt/E2—34 to 40 inches; grayish brown (10YR 5/2) sandy clay loam; few fine distinct yellowish red (5YR 4/6) and many medium distinct yellowish brown (10YR 5/6) mottles; pale brown (10YR 6/3) very fine sandy loam about 30 percent of the horizon (E); weak medium subangular blocky structure; hard, firm; few fine roots; many fine pores; common clay bridging inside ped surfaces; few streaks of cleaned sand grains; few organic stains along root channels; strongly acid; clear smooth boundary.

Bt/E3—40 to 48 inches; yellowish brown (10YR 5/6) sandy clay loam; many fine distinct gray (10YR 5/1) and few fine prominent red (2.5YR 4/6) mottles; pale brown (10YR 6/3) very fine sandy loam about 30 percent of the horizon (E); moderate medium and coarse subangular blocky structure; hard, firm; few fine roots; many fine pores; patchy clay film on faces of peds; few cleaned sand grains along ped surfaces; strongly acid; gradual smooth boundary.

Bt/E4—48 to 55 inches; gray (10YR 5/1) sandy clay loam; common medium distinct brownish yellow (10YR 6/6) and few fine and medium prominent red (2.5YR 4/6) mottles; light yellowish brown (10YR 6/4) very fine sandy loam about 30 percent of the horizon (E); moderate medium subangular blocky structure; hard, firm; few fine roots; common fine and medium pores; apparent clay film along faces of peds; some brittle bodies; strongly acid; clear wavy boundary.

2Cr—55 to 65 inches; light olive brown (2.5YR 6/4) siltstone; few fine faint brownish yellow and yellowish brown mottles.

The thickness of the solum and depth to a paralithic contact of siltstone or sandstone range from 40 to 60 inches.

The A horizon is brown, dark brown, very dark grayish brown, or grayish brown. The E horizon is grayish brown, light brownish gray, pale brown or brown. The combined thickness of the A and E horizons ranges from 15 to 35 inches. Reaction is strongly acid or medium acid.

The Bt/E horizon is mottled and tongued with different colors and textures. High chroma colors range from very pale brown or pale yellow to olive brown or dark yellowish brown. Low chroma colors are grayish brown, light brownish gray, light gray or gray. Reaction ranges from extremely acid to strongly acid. The upper part of the Bt horizon has a clay content that ranges from 8 to 18 percent and has a high percent of silt and very fine sand. The lower part of the Bt horizon is slightly more clayey.

The 2Cr horizon is a grayish, olive, or brownish colored siltstone or sandstone. Gypsum crystals range from none to few.

Kian Series

The Kian series consists of deep, poorly drained, moderately permeable soils on flood plains. They formed in sandy and loamy alluvial sediment. Slope ranges from 0 to 3 percent.

Typical pedon of Kian fine sandy loam in an area of Pluck and Kian soils, frequently flooded; about 4 miles east of Segno from intersection of Farm Road 943 and Farm Road 1276, 0.5 mile northeast on Farm Road 1276 to north side of Big Sandy Creek bridge, and 350 feet southeast; in a forest:

A—0 to 4 inches; brown (10YR 5/3) fine sandy loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure and weak medium granular structure; slightly hard, very friable, nonsticky and nonplastic; common fine roots; many fine and medium pores; few fine soft dark brown masses; few dark stains; neutral; clear wavy boundary.

Bg1—4 to 26 inches; grayish brown (10YR 5/2) fine sandy loam; few medium faint brownish yellow (10YR 6/6) mottles; weak medium subangular

blocky structure; very friable, nonsticky and nonplastic; many fine roots; many fine and few medium pores; few fine soft dark brown masses; few dark stains; neutral; abrupt wavy boundary.

Bg2—26 to 52 inches; light brownish gray (10YR 6/2) fine sandy loam; common medium distinct grayish brown (10YR 5/2) and many medium prominent reddish yellow (7.5YR 6/6) mottles; weak fine subangular blocky structure; very friable, nonsticky and nonplastic; common fine and medium roots; few fine quartz pebbles; few strata of darker finer textured material or lighter sandy textured material about 1/2 inch thick; neutral; gradual boundary.

Bg3—52 to 65 inches; gray (10YR 5/1) clay loam; common medium distinct gray (5Y 6/1), many medium prominent yellowish red (5YR 4/6), and many medium distinct weak red (2.5YR 5/2) mottles; moderate medium subangular blocky structure; very firm, sticky and plastic; many fine roots; few small pebbles; neutral.

The soil typically ranges from medium acid to mildly alkaline but in some pedons, it is strongly acid in some horizons.

The A horizon is brown, grayish brown, dark grayish brown, or dark brown. It is 2 to 5 inches thick. Texture is fine sandy loam or loamy fine sand.

The Bg horizon is dark grayish brown, grayish brown, light brownish gray, gray, or dark gray in the matrix. Mottles range from few to many in shades of yellow, red and brown. The Bg horizon is mainly stratified fine sandy loam and loam, but this horizon also has texture of sandy loam, loamy very fine sand, and loamy fine sand. Contrasting strata of more clayey or more sandy textures occur in some pedons.

Kirbyville Series

The Kirbyville series consists of deep, somewhat poorly drained, moderately permeable soils on uplands in the Coastal Plain. They formed in thick beds of unconsolidated loamy sediment. Slope ranges from 0 to 2 percent.

Typical pedon of Kirbyville fine sandy loam, 0 to 2 percent slopes; from intersection of Farm Roads 943 and 2798 at Segno, 0.4 mile east on Farm Road 943, 300 feet south on dirt road, and 100 feet west of road; in a forest:

A—0 to 4 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; many fine and medium roots, few coarse roots; medium acid; clear smooth boundary.

E—4 to 12 inches; light yellowish brown (10YR 6/4) fine sandy loam; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; few fine and medium roots; few fine pores; medium acid; clear smooth boundary.

Bt1—12 to 16 inches; yellowish brown (10YR 5/6) sandy clay loam; moderate medium subangular blocky structure; hard, firm, sticky and slightly plastic; few fine roots; few fine pores; strongly acid; gradual smooth boundary.

Bt/E1—16 to 28 inches; yellowish brown (10YR 5/6) sandy clay loam; few medium distinct light brownish gray (10YR 6/2) and common medium prominent red (2.5YR 4/6 and 5/6) mottles; moderate medium subangular blocky structure; hard, firm, sticky and plastic; about 5 percent tongues of light yellowish brown (10YR 6/4) fine sandy loam; a few small ironstone concretions; a few nodules of plinthite; very strongly acid; gradual smooth boundary.

Bt/E2—28 to 44 inches; yellowish brown (10YR 5/6) sandy clay loam; few medium distinct light brownish gray (10YR 6/2), common fine prominent red (2.5YR 4/6 and 5/6), and few medium distinct strong brown (7.5YR 5/4) mottles; moderate medium subangular blocky structure, hard, firm, sticky and plastic; about 10 percent tongues of light brownish gray (10YR 6/2) and light yellowish brown (10YR 6/4) fine sandy loam; about 10 percent, by volume, plinthite; few ironstone gravel; very strongly acid; gradual smooth boundary.

Bt/E3—44 to 54 inches; yellowish brown (10YR 5/6) sandy clay loam; few medium distinct light brownish gray (10YR 6/2) and common medium distinct strong brown (7.5YR 5/4) mottles; moderate medium subangular blocky structure; hard, firm, sticky and plastic; about 10 percent tongues of light brownish gray (10YR 6/2) and light yellowish brown (10YR 6/4) fine sandy loam; about 10 percent, by volume, plinthite; few ironstone gravel; very strongly acid; gradual smooth boundary.

Bt/E4—54 to 60 inches; yellowish brown (10YR 5/6) sandy clay loam; few medium distinct light brownish gray (10YR 6/2) common medium distinct strong brown (7.5YR 5/4) and common medium prominent yellowish red (5YR 4/6) mottles; moderate medium subangular blocky structure; hard, firm, sticky and plastic; about 10 percent tongues of light brownish gray (10YR 6/2) and light yellowish brown (10YR 6/4) fine sandy loam; about 5 percent, by volume, plinthite; very strongly acid; gradual smooth boundary.

Bt/E5—60 to 72 inches; brownish yellow (10YR 6/6) sandy clay loam; few medium distinct light brownish gray (10YR 6/2), common medium distinct strong brown (7.5YR 5/4) and common medium prominent yellowish red (5YR 4/6) mottles; moderate medium subangular blocky structure; hard, firm, sticky and plastic; about 15 percent, by volume, tongues of light brownish gray (10YR 6/2) fine sandy loam; few large ironstone gravel; very strongly acid.

The thickness of the solum ranges from 60 to more than 80 inches.

The A horizon is grayish brown, dark grayish brown, brown, pale brown, or light brownish gray. It is 4 to 12 inches thick. Reaction ranges from medium acid to very strongly acid.

The E horizon is pale brown, very pale brown, light yellowish brown, or brownish yellow. It is 6 to 20 inches thick. Reaction ranges from medium acid to very strongly acid.

The Bt/E horizon is mainly sandy clay loam or loam. The upper 20 inches of the Bt/E horizon has a clay content that ranges from 18 to 25 percent. The Bt part of this horizon has a matrix color of yellowish brown, light yellowish brown, brownish yellow, brown, strong brown, or reddish yellow. The tongues of the E part are light brownish gray, light yellowish brown, pale brown, or light gray. Tongues and interfingers of E material make up 5 to 40 percent, by volume, of this horizon and typically increase with depth. Plinthite ranges from 5 to about 15 percent. Mottles in shades of brown, red, and yellow range from few to common. Mottles that are gray because of wetness range from few to common.

Kitterll Series

The Kitterll series consists of shallow and very shallow, well drained, moderately permeable soils on erosional uplands in the Coastal Plain. They formed in interbedded clays, tuffs, ash beds, sandstones, and pyroclastic material, mainly of the Catahoula Formation. Slope ranges from 1 to 8 percent.

Typical pedon of Kitterll fine sandy loam from an area of Colita Variant-Kitterll complex, 1 to 8 percent slopes; from the intersection of U.S. Highway 190 and Farm Road 980 near Point Blank, 7.0 miles north, west on Farm Road 980, 0.3 mile north on trail, and 30 feet east; in a forest:

A—0 to 10 inches; grayish brown (10YR 5/2) fine sandy loam; massive; slightly hard, friable; few fine roots; about 5 percent fragments of sandstone about 1 to 3 inches across; medium acid; abrupt smooth boundary.

Cr—10 to 12 inches; gray (10YR 5/1) weakly cemented sandstone of the Catahoula Formation; massive; hard; hardness of about 2.5 on Mohs' scale.

The thickness of the solum ranges from 4 to 14 inches. Reaction ranges from slightly acid to strongly acid.

The A horizon is dark grayish brown, grayish brown, brown, pale brown, or light brownish gray. Texture is fine sandy loam, loam, or their stony equivalents.

An AC horizon, if present, has the same colors as those in the A horizon. Texture is fine sandy loam, loam, sandy clay loam, or their stony equivalents. The AC horizon also contains gray materials that are similar to those in the Cr horizon.

The Cr horizon ranges from strongly cemented to weakly cemented tuffaceous siltstone, mudstone, or sandstone. Reaction in the upper part of the Cr horizon ranges from strongly acid to neutral.

Laska Series

The Laska series consists of deep, moderately well drained, moderately rapidly permeable soils on complex mounded uplands. They formed in sandy and loamy deposits that contain volcanic material. Slope ranges from 1 to 5 percent.

Typical pedon of Laska fine sandy loam, 1 to 5 percent slopes; from the intersection of U.S. Highway 59 and Farm Road 350 in Moscow, 10.5 miles west on Farm Road 350, 0.6 mile west to Colita, 2.8 miles northwest to Rocky Creek, 0.2 mile northwest, and 50 feet southwest; in a woodland:

A1—0 to 2 inches; grayish brown (10YR 5/2) fine sandy loam; weak fine granular structure; loose, very friable; many fine roots; strongly acid; clear smooth boundary.

A2—2 to 6 inches; brown (10YR 5/3) fine sandy loam; common medium faint brown (10YR 4/3) mottles; weak fine granular structure; loose, very friable; many fine roots; strongly acid; gradual smooth boundary.

A3—6 to 10 inches; dark brown (10YR 4/3) fine sandy loam; common medium faint very dark grayish brown (10YR 3/2) mottles; weak fine granular structure; loose, very friable; many fine roots; strongly acid; gradual smooth boundary.

E—10 to 19 inches; brown (10YR 5/3) fine sandy loam; common fine faint very dark grayish brown (10YR 3/2) and common fine distinct brownish yellow (10YR 6/6) mottles; weak medium subangular blocky structure; loose, very friable; common fine roots; medium acid; gradual smooth boundary.

Bt1—19 to 29 inches; pale brown (10YR 6/3) fine sandy loam; common medium faint dark grayish brown (10YR 4/2) and common medium distinct brownish yellow (10YR 6/6) mottles; weak medium subangular blocky structure; loose, very friable; common fine roots; clay bridging of sand grains; strongly acid; gradual smooth boundary.

Bt2—29 to 72 inches; pale brown (10YR 6/3) loamy very fine sand; common medium distinct brownish yellow (10YR 6/6) mottles and few medium faint dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; loose, very friable; common fine roots; common clay film and bridging of sand grains; very strongly acid; gradual smooth boundary.

BC—72 to 83 inches; pale brown (10YR 6/3) loamy very fine sand; few thin discontinuous horizontal streaks of brownish yellow lamellae; massive; loose, very friable; few fine roots; strongly acid; gradual smooth boundary.

C—83 to 85 inches; very pale brown (10YR 7/3) fine sandy loam; few fine faint brownish yellow mottles; massive; loose, very friable; few fine roots; slightly acid.

The thickness of the solum is more than 60 inches. Siliceous pebbles range from 0 to 5 percent.

The A horizon is dark grayish brown, brown, grayish brown, or dark brown. The A1 horizon may be very dark grayish brown, very dark gray, or dark gray. Mottles range from none to common in shades of gray or brown. The A1 horizon is thinner than 10 inches. Texture is fine sandy loam or loamy very fine sand. Reaction ranges from extremely acid to medium acid.

The E horizon is brown, yellowish brown, pale brown, or light yellowish brown. Mottles range from few to many in shades of gray, brown, or yellow. Texture is fine sandy loam or loamy very fine sand. Reaction ranges from extremely acid to medium acid.

The combined thickness of the A and E horizons ranges from 15 to 35 inches.

The Bt horizon is brown, pale brown, dark brown, dark grayish brown, or grayish brown. Mottles range from few to many in shades of gray, brown, or yellow. Reaction ranges from very strongly acid to medium acid.

The BC and C horizons are grayish brown, light brownish gray, light gray, brown, pale brown, or very pale brown. Mottles range from few to many in shades of gray, brown, or yellow. Texture ranges from fine sandy loam to loamy fine sand and commonly becomes coarse with depth. Reaction ranges from strongly acid to neutral.

Below 60 inches, some pedons have a 2C horizon of grayish soft siltstone or sandstone.

Leggett Series

The Leggett series consists of deep, somewhat poorly drained, moderately permeable soils on uplands. They formed in unconsolidated, acid, loamy sediment. Slope ranges from 0 to 3 percent.

Typical pedon of Leggett fine sandy loam, 0 to 3 percent slopes; from U.S. Highway 59 in Seven Oaks, 0.2 mile south on U.S. Highway 59 to county road, 0.1 mile west, and 15 feet south; in a woodland:

A—0 to 5 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak medium subangular blocky structure; few fine and coarse roots; few fine and medium pores; few black organic stains; strongly acid; clear smooth boundary.

E—5 to 12 inches; grayish brown (10YR 5/2) fine sandy loam; few fine faint brown and few fine distinct light yellowish brown (10YR 6/4) mottles; weak medium subangular blocky structure; slightly hard, very friable; few fine and coarse roots; few medium pores; strongly acid; clear irregular boundary.

Bt/E1—12 to 25 inches; mottled grayish brown (10YR 5/2) and brownish yellow (10YR 6/6) sandy clay loam; light brownish gray (10YR 6/2) fine sandy loam in about 30 percent of the horizon (E); moderate medium subangular blocky structure; very hard, firm; few fine roots; few fine pores; few brown root stains; very strongly acid; gradual smooth boundary.

Bt/E2—25 to 39 inches; mottled light brownish gray (10YR 6/2) and grayish brown (10YR 5/2) sandy clay loam; many medium and coarse prominent brownish yellow (10YR 6/6 and 6/8) mottles; light brownish gray (10YR 6/2) fine sandy loam in about 30 percent of the horizon (E); moderate medium subangular blocky structure; very hard, firm; few fine and medium roots; the tongues of the E material increase with depth; very strongly acid; gradual smooth boundary.

Bt/E3—39 to 56 inches; mottled light brownish gray (10YR 6/2) and grayish brown (10YR 5/2) sandy clay loam; many medium prominent reddish yellow (7.5YR 6/6) and few coarse distinct brownish yellow (10YR 6/6) mottles; light brownish gray (10YR 6/2) fine sandy loam in about 30 percent of the horizon (E); moderate medium subangular structure; very hard, firm; few fine roots; very strongly acid; gradual smooth boundary.

Bt/E4—56 to 72 inches; mottled light brownish gray (10YR 6/2) and grayish brown (10YR 5/2) sandy clay loam; common medium prominent reddish yellow (7.5YR 6/6) mottles; light brownish gray (10YR 6/2) fine sandy loam in about 30 percent of the horizon (E); weak fine subangular blocky structure; very hard, firm; few fine roots; very strongly acid.

The thickness of the solum is more than 60 inches. Tongues of albic material extend to a depth of 50 inches or more. The tongues and interfingerings consist of vertical streaks and masses of albic material 5 millimeters to about 30 millimeters wide, and the percentage increases with depth.

The A horizon is very dark gray, very dark grayish brown, dark gray, dark grayish brown, gray, grayish brown, light gray, light brownish gray, dark olive gray, olive gray, or light olive gray. When value is less than 3.5, the thickness is less than 7 inches. Mottles range from none to common in shades of brown, gray, or yellow. The E horizon is brown, grayish brown, yellowish brown, light brownish gray, pale brown, light yellowish brown, very pale brown, or light olive brown. Mottles range from few to many. Reaction of the A and E horizons ranges from very strongly acid to strongly acid.

The combined thickness of the A and E horizons ranges from 10 to 30 inches.

The Bt/E horizon is gray, grayish brown, light gray, or light brownish gray. Texture is sandy clay loam, silty clay loam, or clay loam. Mottles range from few to many in shades of red, brown, yellow, and gray. The Bt/E1 horizon has a mottled matrix of gray, yellow, and brown. Strongly cemented concretions of iron up to 1/2 inch in diameter range from none to common. Reaction is medium acid to very strongly acid.

Mantachie Series

The Mantachie series consists of deep, somewhat poorly drained, moderately permeable soils on flood plains. They formed in acid, loamy alluvial deposits. Slope ranges from 0 to 1 percent.

Typical pedon of Mantachie loam, in an area of Kian and Mantachie soils, frequently flooded; from U.S. Highway 59 in Corrigan, 3 miles north on U.S. Highway 59, and 100 feet east of highway; in a woodland:

A1—0 to 6 inches; dark brown (10YR 4/3) loam; weak fine subangular blocky and platy structure; slightly hard, friable; many fine and coarse roots; many very fine and medium pores; common worm casts; very strongly acid; clear smooth boundary.

A2—6 to 10 inches; dark grayish brown (10YR 4/2) fine sandy loam; few fine faint yellowish brown mottles; soft, very friable; common fine and coarse roots; many very fine and fine pores, few medium pores; few fine organic stains; very strongly acid; abrupt smooth boundary.

A3—10 to 13 inches; brown (10YR 5/3) fine sandy loam; weak fine subangular blocky structure; soft, very friable; common fine and coarse roots; few very fine pores; many cleaned sand grains; very strongly acid; abrupt smooth boundary.

Bw1—13 to 21 inches; dark grayish brown (10YR 4/2) clay loam; few fine distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; slightly hard, firm; common very fine and fine roots; many very fine and fine pores; small pockets and streaks of clean sand grains; few gypsum crystals; very strongly acid; clear smooth boundary.

Bw2—21 to 43 inches; dark grayish brown (10YR 4/2) loam; few fine distinct yellowish brown (10YR 5/4) mottles; weak fine and medium subangular blocky structure; slightly hard, firm; common fine and coarse roots; common fine pores; few fine organic stains; lenses of white salt or very fine sand grains; few thin strata of clayey material; very strongly acid; clear smooth boundary.

Bw3—43 to 53 inches; dark grayish brown (10YR 4/2) loam; few fine faint yellowish brown mottles; weak fine and medium subangular blocky structure; hard, firm; few very fine roots; many very fine pores; lenses of white powdery very fine sand or silt; very strongly acid; clear smooth boundary.

Bw4—53 to 60 inches; dark grayish brown (10YR 4/2) loam; weak medium subangular blocky structure; hard, firm; few very fine roots; common very fine pores; many lenses of white powdery very fine sand or silt; very strongly acid.

The thickness of the solum ranges from 30 inches to more than 60 inches. Typically the soil is stratified loam, clay loam, silty clay loam, and fine sandy loam. Average clay content of the 10- to 40-inch control section is 22 to 35 percent. Reaction is strongly acid or very strongly acid throughout.

The A horizon is dark brown, dark grayish brown, brown, or yellowish brown, or it is mottled dark brown, dark grayish brown, brown, yellowish brown or gray. It is 5 to 14 inches thick.

The B horizon is dark grayish brown, grayish brown, light brownish gray, or it is mottled in shades of gray, brown, or yellow.

Moswell Series

The Moswell series consists of deep, moderately well drained, very slowly permeable soils on uplands. They formed in acid, shale and mudstone deposits. Slope ranges from 1 to 12 percent.

Typical pedon of Moswell fine sandy loam, 1 to 5 percent slopes; from the intersection of Farm Road 357 and U.S. Highway 59, 1 mile west on Farm Road 357, 0.7 mile north and west on dirt road, and 10 feet north; in a woodland:

A—0 to 5 inches; very dark grayish brown (10YR 3/2) fine sandy loam; few fine faint dark grayish brown mottles; weak medium subangular blocky structure; hard, friable; common fine and coarse roots; common fine pores; strongly acid; abrupt clear boundary.

Bt1—5 to 16 inches; yellowish red (5YR 4/6) clay; few fine and medium distinct yellow (10YR 7/6) mottles; moderate medium subangular blocky structure; extremely hard, very firm; few fine and medium roots; few fine pores; clay film on faces of peds; extremely acid; clear smooth boundary.

Bt2—16 to 22 inches; reddish brown (5YR 5/3) clay; common medium and coarse distinct yellow (10YR 7/6) and few fine distinct red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; extremely hard, very firm; few medium and coarse roots; few fine and medium pores; clay film on faces of peds; extremely acid; gradual smooth boundary.

B/C—22 to 47 inches; horizontally bedded dark reddish brown (5YR 3/2) clay (B) and yellow (10YR 7/6) shaly clay (C); common fine and medium distinct yellowish brown (10YR 5/6) mottles; weak medium

subangular blocky structure (B); extremely hard, very firm; few medium and coarse roots; few shiny ped faces; few seams of light gray material; few gypsum crystals; extremely acid; gradual smooth boundary.

C—47 to 60 inches; brownish yellow (10YR 6/6) horizontally bedded shaly clay; common fine and medium distinct yellowish brown (10YR 5/6) mottles; extremely hard, very firm; extremely acid.

The thickness of the solum ranges from 40 to 60 inches. Electrical conductivity ranges from 2.0 to 8.0 millimhos per centimenter in the lower part of the B and C horizons. The A horizon is brown, dark brown, very dark grayish brown, dark grayish, or grayish brown. It is 1 to 7 inches thick. Reaction ranges from medium acid to very strongly acid.

The B horizon is red, reddish brown, or yellowish red; or in the upper part of this horizon, it is dominantly these colors mottled in shades of brown, gray, or yellow. The lower part of the B horizon is typically mottled in shades of gray, red, yellow, and brown, or has a grayish or brownish matrix that contains a few mottles. Reaction ranges from strongly acid to extremely acid.

The C horizon is clay, shaly clay, very shaly clay, shale, or soft mudstone.

Nahatche Series

The Nahatche series consists of deep, somewhat poorly drained, moderately permeable soils on flood plains. They formed in stratified, loamy alluvial sediment. Slope ranges from 0 to 2 percent.

Typical pedon of Nahatche fine sandy loam, rarely flooded; from Livingstone, 13.3 miles south on U.S. Highway 59, 6.5 miles east on Farm Road 1127 to the end of pavement, 30 feet west, and 200 feet south; in a pasture:

A—0 to 6 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak, medium and fine granular structure; soft, very friable; common fine fibrous roots; common fine and medium pores; stains along root channels; slightly acid; abrupt wavy boundary.

Cg1—6 to 32 inches; grayish brown (10YR 5/2) loam; few fine faint strong brown mottles; moderate medium granular structure and weak medium subangular blocky structure; hard, very friable; few fine roots; few fine pores; common thin strata of silt loam; small partially decomposed vegetative residue; medium acid; clear wavy boundary.

Cg2—32 to 38 inches; grayish brown (10YR 5/2) very fine sandy loam; few fine distinct yellowish brown mottles; weak fine granular structure; slightly hard, very friable; few fine roots; few fine pores; common thin strata of silt loam; small partially decomposed vegetative residue; strongly acid; clear wavy boundary.

Cg3—38 to 55 inches; grayish brown (10YR 5/2) clay loam; few fine prominent yellowish red mottles; moderate medium subangular blocky structure; very hard, very firm; few fine roots; few fine pores; few thin strata of loam and silt loam; strongly acid; clear wavy boundary.

Cg4—55 to 72 inches; dark grayish brown (10YR 4/2) clay loam; many fine prominent yellowish red (5YR 4/6) mottles; moderate medium subangular blocky structure; very hard, very firm; few fine roots; few fine pores; strongly acid.

The A horizon is dark brown, brown, grayish brown, dark grayish brown, or very dark grayish brown. It is 4 to 10 inches thick. Reaction is slightly acid to strongly acid.

The Cg1 horizon is dark gray, gray, grayish brown, or dark grayish brown. The lower part of the Cg horizons have colors that are similar to those in the Cg1 horizons and also light gray and light brownish gray. Mottles in shades of brown, yellow, or red range from few to many. The Cg horizons are stratified loam, fine sandy loam, clay loam, sandy clay loam, very fine sandy loam, or silt loam that have an average clay content of 18 to 30 percent in the 10- to 40-inch control section. This horizon is typically finer textured than the A horizon and has common strata of a coarser material that is about 1 inch to 1/4 inch thick. Reaction is medium acid to mildly alkaline, but in some pedons, it is strongly acid in some subhorizons.

Oakhurst Series

The Oakhurst series consists of deep, somewhat poorly drained, very slowly permeable soils on uplands. They formed in slightly acid to alkaline clayey material underlain by siltstone and sandstone strata. Slope ranges from 1 to 8 percent.

Typical pedon of Oakhurst very fine sandy loam, 1 to 5 percent slopes; from intersection of U.S. Highway 190 and Farm Road 946 in Oakhurst, 3.8 miles north on Farm Road 946, and 100 feet west of road; in a pasture:

A—0 to 5 inches; dark gray (10YR 4/1) very fine sandy loam; weak fine granular structure; friable; many fine roots; strongly acid; clear smooth boundary.

E—5 to 7 inches; grayish brown (10YR 5/2) very fine sandy loam; few fine distinct dark yellowish brown mottles; weak fine granular structure; friable; many fine roots; strongly acid; abrupt wavy boundary.

Btg1—7 to 20 inches; dark grayish brown (10YR 4/2) clay; few fine distinct yellowish brown and light gray mottles; moderate medium coarse blocky structure; extremely hard, very firm; many fine roots; few fine pores; distinct clay film on faces of peds, 1 unit of value darker than crushed peds; vertical cracks through horizon about 2 centimeters wide; few fine

black concretions; strongly acid; gradual wavy boundary.

Btg2—20 to 46 inches; gray (10YR 5/1) clay; few to common medium distinct yellowish brown (10YR 5/4) and pale olive (5Y 6/4) mottles; weak coarse blocky structure; extremely hard, very firm; few fine roots; few fine pores; distinct clay film on faces of peds; few small slickensides; cracks extend downward from horizon above; few black streaks on some faces of peds and along cracks; few fine black concretions; medium acid; gradual wavy boundary.

Cg—46 to 65 inches; light gray (10YR 6/1) silty clay loam; massive; extremely hard, very firm; few fine roots; unconsolidated volcanic tuff; mildly alkaline.

The thickness of the solum ranges from 40 to more than 60 inches. Siliceous pebbles range from none to few throughout. COLE is more than 0.09 in the argillic horizon, and the soil has a potential linear extensibility of 6 centimeters or more in the upper 40 inches.

The A horizon is very dark gray, dark gray, gray, grayish brown, dark grayish brown, or very dark grayish brown. The E horizon is gray, light gray, light brownish gray, or grayish brown. The combined thickness of the A and E horizons averages less than 10 inches in more than 50 percent of the pedon but ranges up to 15 inches in subsoil troughs. Reaction of the A and E horizons ranges from strongly acid to slightly acid. The boundary between the E and Bt horizon is abrupt and is wavy or irregular.

The Btg horizon is dark gray, gray, light brownish gray, grayish brown, or dark grayish brown. Mottles range from few to common in shades of brown, yellow, and olive. Texture is clay, silty clay, silty clay loam, or clay loam. Clay content ranges from 35 to 50 percent. The Btg1 horizon ranges from very strongly acid to slightly acid, and the Btg2 horizon ranges from medium acid to mildly alkaline. Some pedons have a BC horizon that ranges from slightly acid to moderately alkaline.

The Cg horizon is gray, light gray, light brownish gray, or grayish brown. It is clay, silty clay loam, clay loam or sandy clay loam. Some pedons contain concretions of calcium carbonate and crystals of gypsum. Reaction ranges from slightly acid to moderately alkaline. Though not diagnostic, soft siltstone or sandstone is common below 40 inches.

Otanya Series

The Otanya series consists of deep, moderately well drained, moderately slowly permeable soils in the Coastal Plain. They formed in thick beds of unconsolidated loamy sediment of Pleistocene age. Slope ranges from 0 to 3 percent.

Typical pedon of Otanya fine sandy loam, 0 to 3 percent slopes; from the intersection of Texas Highway 146 and Farm Road 943 about 11 miles south of Livingston, 6.5 miles east on Farm Road 943 to Liberty Hill fire tower, 4.3 miles southwest on dirt road, 0.7 mile east on forest trail, and 150 feet north; in a woodland:

A—0 to 4 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak medium granular structure; soft, very friable; common fine roots; few rounded ironstone pebbles up to 10 millimeters in diameter; slightly acid; clear smooth boundary.

E—4 to 9 inches; very pale brown (10YR 7/4) fine sandy loam; weak fine subangular blocky structure parting to weak medium granular structure; soft, very friable; few fine, medium and coarse roots; few rounded ironstone pebbles up to 20 millimeters in diameter; strongly acid; clear smooth boundary.

Bt—9 to 17 inches; strong brown (7.5YR 5/8) sandy clay loam; weak medium subangular blocky structure; hard, firm; common fine roots; thin patchy clay film on faces of peds; few rounded ironstone pebbles up to 5 millimeters in diameter; strongly acid; gradual smooth boundary.

Btc—17 to 28 inches; strong brown (7.5YR 5/6) sandy clay loam; common medium distinct red (2.5YR 4/8) mottles; weak medium subangular blocky structure; hard, firm; common fine roots; thin patchy clay film on faces of peds; about 10 percent rounded ironstone pebbles up to 20 millimeters in diameter; very strongly acid; gradual smooth boundary.

Btv1—28 to 48 inches; strong brown (7.5YR 5/6) sandy clay loam; common medium and coarse distinct red (2.5YR 4/8) and common medium distinct yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; hard, firm; common fine roots; thin patchy clay film on faces of peds; about 10 percent, by volume, of plinthite; about 5 percent, by volume, of brittle masses; few rounded ironstone pebbles up to 15 millimeters across; very strongly acid; gradual smooth boundary.

Btv2—48 to 65 inches; strong brown (7.5YR 5/8) sandy clay loam; common medium distinct red (2.5YR 4/8), and light yellowish brown (2.5YR 6/4), and few medium distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; hard, firm; thin patchy clay film on faces of peds; about 10 percent, by volume, of plinthite; about 5 percent, by volume, of brittle masses; few small spots of uncoated sand; very strongly acid.

The thickness of the solum ranges from 60 to more than 80 inches. Plinthite makes up 5 to 15 percent of some subhorizons within 60 inches of the surface. Base saturation ranges from 10 to 35 percent. Clay content in the upper 20 inches of the argillic horizon ranges from 18 to 35 percent.

The A horizon is very dark gray, dark gray, gray, light brownish gray, grayish brown, dark grayish brown, very dark grayish brown, dark brown, brown, or pale brown.

The E horizon is dark grayish brown, grayish brown, light brownish gray, very pale brown, pale brown, brown, dark brown, pale yellow, light yellowish brown, or light olive brown. The combined A and E horizons range from 7 to 25 inches thick. Ironstone pebbles range from 0 to 10 percent by volume. Reaction in the A and E horizons ranges from very strongly acid to slightly acid.

The Bt and Btc horizons are brown, light brown, strong brown, reddish yellow, light yellowish brown, yellowish brown, or brownish yellow. Mottles in shades of brown and red range from none to common. Texture is sandy clay loam, clay loam, or fine sandy loam. Plinthite ranges from 0 to 5 percent. Reaction is very strongly acid or strongly acid. The Btv horizon is the same colors as those in the upper part of the Bt horizon. Mottles in shades of brown, red, gray, and yellowish brown range from few to common. Depth to horizons that have mottles with chromas of 2 or less is more than 30 inches. Plinthite ranges from 5 to 25 percent. Up to 10 percent of some horizons are brittle, mainly, in the red and yellowish brown areas. Texture is sandy clay loam or clay loam. Reaction is very strongly acid or strongly acid.

Ozias Series

The Ozias series consists of deep, somewhat poorly drained, very slowly permeable soils on flood plains. They formed in acid, clayey, alluvial sediment. Slope ranges from 0 to 1 percent.

Typical pedon of Ozias silty clay loam, in an area of Ozias-Pophers complex, frequently flooded; from the intersection of U.S. Highway 59 in Corrigan, 8 miles north on U.S. Highway 59, 0.6 mile east on gravel road, and 70 feet southeast; in a woodland:

A—0 to 5 inches; dark brown (10YR 3/3) silty clay loam; common fine faint grayish brown and yellowish brown mottles; weak fine subangular blocky structure; hard, firm; many fine and coarse roots; common very fine pores; many worm casts; few fine black concretions; very strongly acid; clear smooth boundary.

Bg1—5 to 19 inches; dark grayish brown (10YR 4/2) silty clay; few fine faint yellowish brown mottles; weak medium subangular blocky structure; very hard, very firm; many fine to coarse roots; common fine pores; many fine black concretions; few organic stains; very strongly acid; clear smooth boundary.

Bg2—19 to 32 inches; dark grayish brown (10YR 4/2) clay loam; common medium distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; very hard, very firm; common fine roots; few fine pores; common fine black concretions; very strongly acid; abrupt smooth boundary.

Bg3—32 to 50 inches; dark grayish brown (10YR 4/2) clay loam; common fine and medium distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; hard, firm; few fine roots; few very fine pores; very strongly acid; gradual smooth boundary.

Bg4—50 to 60 inches; dark grayish brown (10YR 4/2) clay loam; few fine distinct yellowish brown (10YR 5/8) and few fine prominent reddish brown (5YR 4/4) mottles; weak medium subangular blocky structure; hard, firm; few very fine roots; few very fine pores; very strongly acid.

The thickness of the solum ranges from 40 to more than 60 inches. Reaction throughout the upper 40 inches is extremely acid or very strongly acid. Texture is silty clay loam, clay loam, silty clay, or clay. Strata of other textures occur in the lower part of some pedons.

The A horizon is very dark grayish brown, dark grayish brown, grayish brown, brown, or dark brown. It is 3 to 9 inches thick.

The Bg horizon is gray, dark gray, light brownish gray, grayish brown, or dark grayish brown. Mottles in shades of red, yellow, and brown range from none to common. Electrical conductivity of the saturation extract from the B horizon ranges from 2 to 8 millimhos per centimeter.

Pinetucky Series

The Pinetucky series consists of deep, moderately well drained, moderately slowly permeable soils on uplands. They formed in loamy sediment of Pleistocene age. Slope ranges from 1 to 5 percent.

Typical pedon of Pinetucky fine sandy loam, 1 to 5 percent slopes; from intersection of U.S. Highway 59 and Farm Road 942 in Leggett, 5.4 miles east on Farm Road 942, 1.8 miles southeast and south on dirt road, 200 feet west; in a forest:

A—0 to 6 inches; dark grayish brown (10YR 4/2) fine sandy loam; grayish brown (10YR 5/2) dry; weak granular structure; soft, very friable; many fine roots; few worm casts; and few to common ironstone gravel 5 to 10 millimeters in diameter; medium acid; clear smooth boundary.

E—6 to 12 inches; pale brown (10YR 6/3) fine sandy loam; weak fine subangular blocky structure; soft, very friable; many roots; common fine pores; few worm casts; contains few ironstone gravel 5 to 10 millimeters in diameter; medium acid; clear wavy boundary.

Bt—12 to 28 inches; yellowish brown (10YR 5/6) sandy clay loam; few fine and medium distinct strong brown (10YR 5/6) and reddish yellow (5YR 6/6) mottles; weak medium subangular blocky structure; hard, friable; common fine roots; common fine pores; thin patchy clay film on faces of peds and in pores; few worm casts; few fine ironstone pebbles; strongly acid; gradual wavy boundary.

Btv1—28 to 56 inches; yellowish brown (10YR 5/6) sandy clay loam; common medium prominent red (2.5YR 5/6) and yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; very hard, friable; few fine roots; common fine pores; thin patchy clay film on faces of peds and in pores; about 10 percent, by volume, plinthite; few fine ironstone pebbles; strongly acid; diffuse wavy boundary.

Btv2—56 to 70 inches; prominently mottled light gray (10YR 6/2), red (2.5Y 4/8) and strong brown (7.5YR 5/6) sandy clay loam; weak coarse blocky structure; very hard, friable; few fine roots; few fine pores; about 2 percent, by volume, plinthite; clay film on faces of peds; very strongly acid.

The thickness of the solum is more than 60 inches. Depth to a horizon that contains more than 5 percent plinthite is 25 to 60 inches. Strongly cemented to indurated iron oxide concretions less than 2 centimeters in diameter range from 0 to 10 percent in the A horizon and from 0 to 5 percent in the Bt horizon. Base saturation at 50 inches below the top of the Bt horizon ranges from 5 to 20 percent.

The A horizon is brown, grayish brown, or dark grayish brown. It is 4 to 13 inches thick. Texture is fine sandy loam, sandy loam, or loamy fine sand. Reaction ranges from medium acid to very strongly acid. The E horizon is brown, pale brown, light yellowish brown, or yellowish brown. It is 4 to 13 inches thick. Texture is fine sandy loam, sandy loam, or loamy fine sand. Reaction is medium acid to very strongly acid.

The combined thickness of the A and E horizons is 8 to 20 inches.

The Bt horizon is brownish yellow, yellowish brown, strong brown, reddish yellow, or brown. Mottles in shades of red, yellow, and brown range from few to many. The Btv1 and Btv2 horizons have colors that are similar to those in the Bt horizon and commonly contain mottles of gray, light gray, and pale brown. The Btv1 horizon contains 5 to 20 percent plinthite in some parts. Texture of the Bt horizon is sandy clay loam or clay loam throughout. The clay content ranges from 20 to 35 percent. It is strongly acid to very strongly acid.

Pluck Series

The Pluck series consists of deep, poorly drained, moderately permeable soils on flood plains. They formed in acid, loamy alluvium. Slope ranges from 0 to 3 percent.

Typical pedon of Pluck fine sandy loam, in an area of Pluck and Kian soils, frequently flooded; about 4 miles northwest of Cleveland, from intersection of Farm Road 1725 and Liberty County line, north 1,300 feet on Farm Road 1725, northeast 900 feet on gravel road, 1,200 feet southeast on utility right-of-way, and 300 feet south; in a pasture:

A1—0 to 2 inches; brown (10YR 4/3) fine sandy loam; weak medium granular structure; soft, very friable; common fine roots; common fine and medium pores; few dark stains along root channels; neutral; abrupt wavy boundary.

A2—2 to 6 inches; brown (10YR 5/3) fine sandy loam; weak medium subangular blocky structure and weak medium granular structure; slightly hard, very friable; common fine roots; many fine and medium pores; few fine soft dark brown masses; few dark stains; neutral; clear wavy boundary.

Cg1—6 to 26 inches; light brownish gray (10YR 6/2) fine sandy loam; few medium faint brownish yellow (10YR 6/6) mottles; massive; very friable; many fine roots; many fine and medium pores; few fine soft dark brown masses; few dark stains; neutral; abrupt wavy boundary.

Cg2—26 to 35 inches; grayish brown (10YR 5/2) sandy clay loam; few fine faint and few medium faint brownish yellow (10YR 6/6) mottles; weak medium subangular blocky structure; friable; few fine roots; few fine pores; common thin strata of silt loam, small partially decomposed forest residue; neutral; clear wavy boundary.

Cg3—35 to 52 inches; light brownish gray (10YR 6/2) sandy clay loam; common fine and medium faint light yellowish brown (10YR 6/4) and brownish yellow (10YR 6/6) mottles; weak medium subangular blocky structure; firm; few fine and medium roots; few fine pores; mildly alkaline; clear wavy boundary.

Cg4—52 to 65 inches; dark gray (10YR 4/1) silty clay loam; many fine and medium faint light yellowish brown (10YR 6/4) and brownish yellow (10YR 6/6) mottles; weak medium subangular blocky structure; firm, sticky and plastic; few fine and medium roots; few fine pores; mildly alkaline.

The soil typically ranges from medium acid to mildly alkaline but in some pedons, it is strongly acid in some subhorizons.

The A horizon is brown, dark brown, dark grayish brown, grayish brown, or dark gray. Typically, the horizon is stratified fine sandy loam, loam, or silt loam and less commonly silty clay loam, or it has thin strata of loamy fine sand. It is 4 to 10 inches thick.

The Cg horizon is dark grayish brown, grayish brown, gray, and dark gray. Mottles in shades of yellow and brown range from few to many. The Cg horizon is stratified loam, silt loam, fine sandy loam, sandy loam, silty clay loam, and clay loam. The average clay content ranges from 18 to 35 percent in the 10- to 40-inch control section. Thin strata of more sandy or more clayey textures occur in some pedons. Buried horizons below 40 inches occur in some pedons. Typically, the soil becomes more clayey with depth.

Pophers Series

The Pophers series consists of deep, somewhat poorly drained, slowly permeable soils on flood plains. They formed in acid, loamy alluvial sediment. Slope ranges from 0 to 1 percent.

Typical pedon of Pophers silty clay loam, frequently flooded; from the intersection of U.S. Highway 59 in Corrigan, 8 miles north on U.S. Highway 59, 0.6 mile east on gravel road, and 50 feet north; in a woodland:

A—0 to 2 inches; dark brown (10YR 3/3) silty clay loam; weak fine subangular blocky and granular structure; slightly hard, firm; many very fine and fine roots, few medium and coarse roots; few very fine and fine pores; medium acid; abrupt smooth boundary.

Bw—2 to 9 inches; dark yellowish brown (10YR 4/4) silty clay loam; common fine distinct gray (10YR 5/1) and few fine distinct yellowish red (5YR 4/6) mottles; weak medium subangular blocky structure; slightly hard, firm; common fine and medium roots, few coarse roots; few very fine and fine pores; common stratified cleaned sand grains; very strongly acid; clear smooth boundary.

Bg1—9 to 20 inches; gray (10YR 5/1) silty clay loam; common fine distinct yellowish red (5YR 4/6) and many fine and medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure parting to weak fine platy; slightly hard, firm; few very fine and fine roots; many very fine and fine pores; common stratified cleaned sand grains; very strongly acid; abrupt smooth boundary.

Bg2—20 to 44 inches; gray (10YR 5/1) clay loam; common medium and coarse distinct yellowish brown (10YR 5/6) and few fine distinct yellowish red (5YR 4/6) mottles; weak medium subangular blocky structure; slightly hard, firm; few very fine and fine roots; few very fine pores; common stratified cleaned sand grains; very strongly acid; clear smooth boundary.

Bg3—44 to 60 inches; gray (10YR 5/1) clay loam; common fine distinct yellowish brown (10YR 5/6) and few fine distinct yellowish red (5YR 4/6) mottles; weak medium subangular blocky structure parting to weak fine platy; slightly hard, firm; few very fine pores; very strongly acid.

The A horizon ranges from 2 to 10 inches thick. It is grayish brown, dark grayish brown, very dark grayish brown, brown, or dark brown. Reaction ranges from very strongly acid to medium acid.

The Bw horizon is absent in some pedons, but, if present, it is dark brown, brown, yellowish brown, or dark yellowish brown. It has grayish mottles. The Bg horizon is dark gray, gray, light gray, dark grayish brown, grayish brown, or light brownish gray. Mottles in shades of yellow, brown or red range from few to many. Texture is silty clay loam, clay loam, or loam. Reaction ranges from extremely acid to strongly acid. Electrical conductivity ranges from about 0.5 to 4 millimhos per centimeter. A Cg horizon, if present, has colors and textures that are similar to those in the Bg horizon but, in some places, includes strata of a coarser or finer texture. Electrical conductivity ranges from 4 to 8 millimhos per centimeter.

Rayburn Series

The Rayburn series consists of deep, moderately well drained, very slowly permeable soils on uplands. They formed in acid, tuffaceous siltstones and sandstones. Slope ranges from 1 to 15 percent.

Typical pedon of Rayburn fine sandy loam, 5 to 15 percent slopes; from the intersection of U.S. Highway 287 and Farm Road 62, 0.6 mile northeast on county road, 1.3 miles northwest on county road, 0.7 mile northeast on county road, and 50 feet east; in a woodland:

A—0 to 3 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak medium subangular blocky structure; slightly hard, friable; common fine roots; very strongly acid; clear smooth boundary.

E—3 to 7 inches; grayish brown (10YR 5/2) fine sandy loam; common fine faint dark grayish brown (10YR 4/2) and brown (10YR 4/3) mottles; weak medium subangular blocky structure; slightly hard, friable; common fine roots; very strongly acid; abrupt smooth boundary.

Bt1—7 to 19 inches; red (2.5YR 4/6) clay; few fine prominent light brownish gray (10YR 6/2) and few medium distinct strong brown (7.5YR 5/6) mottles; moderate medium angular blocky structure; very firm, very hard; few fine roots; few small pressure faces; very strongly acid; gradual smooth boundary.

Bt2—19 to 32 inches; coarsely mottled light brownish gray (10YR 6/2), red (2.5YR 4/6), and strong brown (7.5YR 5/6) clay; weak medium angular blocky structure; very firm, very hard; few fine pressure faces; very strongly acid; gradual smooth boundary.

Bt3—32 to 48 inches; coarsely mottled light brownish gray (10YR 6/2), strong brown (7.5YR 5/6) and red (2.5YR 4/6) clay; few fine faint light gray (10YR 7/1) mottles; weak medium angular blocky structure; very firm, very hard; very strongly acid; gradual smooth boundary.

BC—48 to 55 inches; mottled pale brown (10YR 6/3) and strong brown (7.5YR 5/6) clay; common medium distinct red (2.5YR 4/6) and yellowish red (5YR 5/6) mottles; weak coarse angular blocky structure; very firm, very hard; very strongly acid; gradual smooth boundary.

Cr—55 to 62 inches; light gray (2.5Y 7/2) weakly consolidated sandstone, common medium distinct reddish brown (5YR 5/4) and common fine and

medium faint pale brown (10YR 6/3) mottles; massive; very strongly acid.

The thickness of the solum ranges from 40 to 60 inches. If dry, these soils have cracks that are 1 centimeter or more wide in the upper part of the subsoil.

The A horizon is dark grayish brown, very dark grayish brown, brown, dark brown, grayish brown, gray, or dark gray. It is 3 to 10 inches thick. Reaction is very strongly acid to medium acid.

The E horizon, if present is grayish brown, brown, pale brown, or light brownish gray. Reaction is very strongly acid or strongly acid.

The Bt1 horizon is red, reddish brown, or yellowish red. A few grayish or brownish mottles are in most pedons. Reaction is very strongly acid or strongly acid.

The lower part of the Bt horizon and BC horizon is mostly strong brown, grayish brown, pale brown, light brownish gray, light olive gray, olive, or pale olive. Common mottles of red, reddish brown, and yellowish red are near the upper part and light and light yellowish brown mottles are in the lower part. The Bt horizon is clay or silty clay. The clay content in the upper 20 inches ranges from 40 to 60 percent. Reaction is very strongly acid or strongly acid.

The Cr horizon is weakly consolidated sandstone or siltstone that contains volcanic ash and other pyroclastic material.

Sorter Series

The Sorter series consists of deep, poorly drained, slowly permeable soils in slightly concave to level areas and incipient drainageways in the Coastal Plain. They formed in thick beds of unconsolidated, sandy loam, silt loam, and loamy sediment. Slope ranges from 0 to 1 percent.

Typical pedon of Sorter silt loam, 0 to 1 percent slopes; from Livingston, 23.8 miles south on U.S. Highway 59, 0.4 mile west, 0.15 mile south, and 20 feet east; in a woodland:

A—0 to 4 inches; grayish brown (10YR 5/2) silt loam; weak fine granular structure; slightly hard, friable; many fine pores; many fine roots; few ironstone pebbles; medium acid; clear boundary.

E—4 to 14 inches; light brownish gray (10YR 6/2) loam; many coarse faint and distinct brownish yellow (10YR 6/6) mottles; weak fine granular structure; hard, very friable; many fine and medium roots; many medium and fine pores; many crayfish krotovina; medium acid; diffuse irregular boundary.

Btg1—14 to 31 inches; light brownish gray (10YR 6/2) loam; many medium faint yellowish brown (10YR 5/6) mottles; weak coarse blocky structure; hard, friable; many fine roots; very thin patchy clay film in pores; few ironstone pebbles; many crayfish krotovina partially clay coated; medium acid; diffuse irregular boundary.

Btg2—31 to 52 inches; light brownish gray (10YR 6/2) loam; many medium faint yellowish brown (10YR 5/6) mottles; weak coarse blocky structure; hard, friable; few fine roots; many fine and medium pores; weak patchy clay film in pores; many ironstone pebbles; coatings of dark gray flow clay up to 1 millimeter thick in vertical crevices and on crayfish krotovina walls; medium acid; diffuse irregular boundary.

B/C—52 to 65 inches; gray (10YR 6/1) silt loam; many medium distinct reddish yellow (7.5YR 6/6) and few fine prominent light olive brown (2.5Y 5/8) mottles; weak coarse subangular blocky structure; very hard, firm; few fine roots; medium acid.

The thickness of the solum ranges from 60 to more than 100 inches. Structure is weakly expressed with crayfish actively mixing the soil.

The A horizon is light brownish gray, grayish brown, light gray, or gray. It is 2 to 6 inches thick. The E horizon is light brownish gray, white, or light gray and has mottles in shades of yellow or brown. It is 10 to 25 inches thick. Texture of the A and E horizons is silt loam, loam, or very fine sandy loam. Clay content is less than 10 percent.

The Btg horizon is light gray, light brownish gray, or gray and has yellow, yellowish brown, yellowish red, or brown mottles. Texture is silt loam, or loam. The content of clay is less than 18 percent, content of silt is more than 40 percent, and the content of sand that is coarser than very fine sand is 15 to 30 percent. Reaction ranges from medium acid to very strongly acid.

Splendora Series

The Splendora series consists of deep, somewhat poorly drained, slowly permeable soils on uplands in the Coastal Plain. They formed in thick beds of unconsolidated, loamy sediment. Slope ranges from 0 to 2 percent.

Typical pedon of Splendora very fine sandy loam, 0 to 2 percent slopes; from the intersection of Farm Road 945 and Farm Road 2025, 2 miles west on Farm Road 945, 2.3 miles southwest on county road to Farm Road 1725, 3.9 miles south on county road, and 0.8 mile northwest; in a woodland:

A—0 to 4 inches; dark grayish brown (10YR 4/2) very fine sandy loam; massive; hard, very friable; common tree roots; medium acid; clear irregular boundary.

E—4 to 10 inches; grayish brown (10YR 5/2) fine sandy loam; weak medium subangular blocky structure; hard, friable; common roots; many fine pores; light brownish gray areas show strong evidence of clay

stripping leaving clean sand and silt grains; few fine strongly cemented iron pebbles; few worm casts; strongly acid; gradual wavy boundary.

Bt—10 to 20 inches; light yellowish brown (10YR 6/4) loam; common coarse distinct yellowish brown (10YR 5/6) mottles; common fine distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; hard, friable; common roots; many fine pores; light brownish gray areas show strong evidence of clay stripping leaving clean sand and silt grains; few fine strongly cemented iron pebbles; few worm casts; very strongly acid; gradual irregular boundary.

Bt/E1—20 to 22 inches; light brownish gray (10YR 6/2) loam; many medium and coarse distinct yellowish brown (10YR 5/6) mottles; weak subangular blocky structure; hard, friable; common roots; common fine pores; light brownish gray areas mostly of E material, stripped of clay and tongued into horizons above and below; common fine strongly cemented iron concretions; very strongly acid; clear irregular boundary.

Bt/E2—22 to 46 inches; mottled yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8) sandy clay loam; ped interiors (B) about 20 percent tongues of light brownish gray (10YR 6/2) loam; few yellowish red mottles that have brittle center (E); weak subangular blocky structure; hard, firm; few fine roots; patchy clay film on faces of peds; about 30 percent of ped interior of brittle common strongly cemented iron pebbles; very strongly acid; gradual wavy boundary.

Bt/E3—46 to 69 inches; mottled yellowish brown (10YR 5/6) and red (2.5YR 4/8) sandy clay loam; ped interiors (B) about 15 percent tongues of light brownish gray (10YR 6/2) loam; weak subangular and angular blocky structure (E); very hard, friable; few roots in gray areas; patchy clay film on faces of peds; coarse red mottles, slightly brittle, comprise 15 to 25 percent of the mass; few nodules of plinthite; few strongly cemented iron concretions; strongly acid; diffuse wavy boundary.

Bt/E4—69 to 95 inches; mottled light gray (10YR 7/2), brownish yellow (10YR 6/6), and yellowish red (5YR 5/6) sandy clay loam; ped interiors with about 10 percent tongues and interfingers of light gray (10YR 7/2); weak blocky structure with polygons about 6 inches in diameter surrounded by bleached sand and silt coatings; extremely hard, friable; few nodules of plinthite; few clay flows; strongly acid.

The thickness of the solum ranges from 60 to more than 100 inches. Depth to a horizon that has some brittle properties ranges from 18 to 40 inches. Few to 15 percent, by volume, slightly pitted iron concretions that are less than 1/2 inch in diameter, occur in some horizons.

The A horizon is gray, light brownish gray, grayish brown, dark grayish brown, or very dark grayish brown and in cultivated areas, the lighter colors are the Ap horizon. It ranges from 3 to 10 inches thick. The E horizon is light gray, brown, grayish brown, pale brown, light brownish gray, or very pale brown. This horizon may have faint mottles of yellows and browns. The E horizon ranges from fine sandy loam or very fine sandy loam to loam. Reaction of the A and E horizons is strongly acid or medium acid.

The Bt horizon is brown, yellowish brown, or light yellowish brown, distinctly mottled in shades of yellow, yellowish brown, and gray. Mottles are medium and coarse. The gray areas comprise 15 to 40 percent of the horizon. They are vertically oriented and do not have evidence of clay coating. The Bt horizon ranges from fine sandy loam or loam to sandy clay loam. Clay content ranges from 18 to 24 percent. It is 6 to 14 inches thick. Reaction is very strongly acid or strongly acid. The Bt/E horizon contains tongues and interfingers of albic material that make up 25 to 50 percent, by volume, in the zone of maximum expression. Texture is sandy clay loam, loam, or fine sandy loam that is 18 to 28 percent clay, 20 to 45 percent silt, and more than 15 percent sand that is coarser than very fine sand. It has weak moderate subangular blocky to angular blocky structure. The patchy clay film on faces of peds are gray. The Bt part of this horizon is sandy clay loam or clay loam mainly in shades of brown or yellowish brown. It has few and common, medium and coarse gray, red, yellowish red, or strong brown mottles. The redder mottles have brittle centers and are surrounded by yellowish brown. Plinthite comprises less than 5 percent of the horizon.

The E part is tongues and interfingers of light gray or light brownish gray loamy very fine sand, fine sandy loam, or loam. Brittle masses make up 25 to 50 percent, by volume, of this horizon. Reaction is strongly acid or very strongly acid.

Spurger Series

The Spurger series consists of deep, moderately well drained, slowly permeable soils on erosional terraces. They formed in clayey and sandy alluvium of late Pleistocene age. Slope ranges from 1 to 15 percent.

Typical pedon of Spurger fine sandy loam, 1 to 5 percent slopes; from Onalaska, 3 miles north, west on Farm Road 356, 200 feet north; in a woodland:

A—0 to 3 inches; brown (10YR 4/3) fine sandy loam; moderate medium granular structure; slightly hard, very friable; many fine roots; strongly acid; abrupt smooth boundary.

E—3 to 8 inches; brown (10YR 5/3) fine sandy loam; many coarse faint pale brown (10YR 6/3) and few medium faint dark grayish brown mottles; weak fine

granular structure; slightly hard, very friable; common fine and medium roots; strongly acid; clear smooth boundary.

Bt1—8 to 25 inches; red (2.5YR 5/6) clay; few fine distinct strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2) mottles in the lower part; moderate medium subangular blocky structure; very hard, very firm; few medium and coarse roots; thin patchy clay film on faces of peds; very strongly acid; gradual wavy boundary.

Bt2—25 to 31 inches; red (2.5YR 5/6) clay; many medium prominent light brownish gray (10YR 6/2) mottles; moderate medium angular blocky structure; very hard, very firm; few medium and coarse roots; thin patchy clay film on faces of peds; very strongly acid; gradual smooth boundary.

Bt3—31 to 44 inches; red (2.5YR 5/6) clay loam; few fine distinct red and common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; hard, very firm; few fine roots; thin patchy clay film on faces of peds; very strongly acid; gradual smooth boundary.

BC—44 to 56 inches; mottled light brownish gray (10YR 6/2) and red (2.5YR 5/6) sandy clay loam; moderate medium angular blocky structure; very hard, firm; few fine roots; very strongly acid; gradual smooth boundary.

C—56 to 72 inches; mottled yellowish red (5YR 5/8) and light brownish gray (10YR 6/2) fine sandy loam; hard, firm; very strongly acid.

The thickness of the solum ranges from 40 to 70 inches. Reaction is strongly acid or very strongly acid except where the surface layer has been limed. Base saturation ranges from 35 to 60 percent at 50 inches below the top of the Bt horizon.

The A horizon is dark brown, brown, grayish brown, dark grayish brown, and very dark grayish brown. It is 3 to 7 inches thick.

The E horizon is grayish brown, light brownish gray, pale brown, brown, light yellowish brown, or yellowish brown. It is 3 to 10 inches thick. The E horizon is absent in some of the more sloping areas. Texture is loam or fine sandy loam.

The Bt horizon is mainly red, dark red, or yellowish red, but some pedons are other shades of red, yellow, or brown. Mottles that have chroma of 2 or less occur in the upper 10 inches of the Bt horizon. Mottles in shades of gray, brown, yellow, and red occur throughout the horizon. Some pedons have bleached sand and silt coatings or interfingerings of E material in the lower part of the Bt horizon. Texture of the Bt1 and Bt2 horizons is clay or clay loam. Texture of the Bt3 horizon is clay loam, sandy clay loam, or loam.

The BC and C horizons have colors in shades of red, yellow, or brown. Mottles in shades of gray range from few to many. Texture of the BC horizon is sandy clay loam, loam, or clay loam, and in the C horizon, it is fine sandy loam, loamy fine sand, or sand. Strata of clay loam and loam occur in the C horizon of some pedons.

Stringtown Series

The Stringtown series consists of deep, well drained, moderately permeable soils on side slopes and ridges on uplands. They formed in unconsolidated, acid, loamy sediment. Slope ranges from 5 to 12 percent.

Typical pedon of Stringtown fine sandy loam, in an area of Stringtown-Bonwier association, strongly sloping; from the U.S. Post Office in Dallardsville on Farm Road 1276, 4.5 miles northeast on gravel road, 0.2 mile southeast, and 600 feet north; in a woodland:

A—0 to 5 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak fine subangular blocky and granular structure; soft, very friable; many very fine and fine roots; few fine pores; few coarse fragments; medium acid, abrupt smooth boundary.

E—5 to 8 inches; yellowish brown (10YR 5/4) fine sandy loam; common fine distinct dark grayish brown (10YR 4/2) mottles; weak fine subangular blocky and granular structure; soft, very friable; many fine and coarse roots; few fine pores; common fine gravel; medium acid; clear smooth boundary.

Bt1—8 to 20 inches; strong brown (7.5YR 5/8) sandy clay loam; few fine prominent red (2.5YR 4/6) and few fine distinct grayish brown (10YR 5/2) weathered shale fragments; weak fine and medium subangular blocky structure; very hard, very firm; common very fine roots; few fine pores; few fine gravel; few organic stains along root channels; clay film on faces of peds; medium acid; clear smooth boundary.

Bt2—20 to 30 inches; yellowish brown (10YR 5/8) sandy clay loam; few fine distinct red (2.5YR 4/6) mottles; weak fine and medium subangular blocky structure; slightly hard, firm; few fine roots; common very fine pores; clay film on faces of peds; about 1 percent plinthite; medium acid; clear wavy boundary.

BC—30 to 50 inches; yellowish brown (10YR 5/8) sandy clay loam; common fine medium distinct light gray (10YR 7/2) and common fine distinct red (2.5YR 4/6) mottles; weak fine and medium subangular blocky structure; slightly hard, firm; many fine pores; clay film on faces of peds; approximately 1 percent plinthite; very strongly acid; diffuse boundary.

C—50 to 65 inches; thinly bedded yellowish brown (10YR 5/8) and light gray (10YR 7/2) soft sandstone and shale; strata 1/2 inch to 2 inches thick; very strongly acid.

The thickness of the solum ranges from 40 to 60 inches.

Ironstone pebbles and angular fragments make up 1 to 15 percent, by volume, of the A horizon. Plinthite ranges from none to 5 percent, by volume, in the lower part of the Bt horizon. Base saturation ranges from 25 to 35 percent.

The A horizon is grayish brown, dark grayish brown, very dark grayish brown, dark yellowish brown, or brown. It is 2 to 6 inches thick. The E horizon is brown, pale brown, yellowish brown, or light yellowish brown. It is 4 to 6 inches thick. Reaction in the A and E horizons ranges from slightly acid to very strongly acid. Texture of the A and E horizons ranges from fine sandy loam to loamy fine sand.

The Bt horizon is sandy clay loam or clay loam. Reaction is medium acid to very strongly acid. This horizon is reddish yellow, strong brown, brownish yellow, or yellowish brown and has mottles of red, yellow, brown, and gray. Gray colors are believed to be weathered shale fragments.

The BC horizon is mottled in shades of yellow, red, brown, and gray. It commonly contains fragments of shale and sandstone. Reaction ranges from strongly acid to extremely acid.

The C horizon is stratified sandy clay loam, shale, and sandstone in gray, red, and brown.

Voss Series

The Voss series consists of deep, moderately well drained, rapidly permeable soils on flood plains and on low stream terraces. They formed in deep, sandy alluvium. Slope ranges from 0 to 3 percent.

Typical pedon of Voss sand, frequently flooded; from the intersection of U.S. Highway 190 and Farm Road 3152, 1.6 miles northeast, 1.9 miles northwest, and 2,300 feet east to Rocky Creek.

A—0 to 4 inches; dark grayish brown (10YR 4/2) sand; single grained; loose; few fine roots; medium acid; clear boundary.

C1—4 to 25 inches; light brownish gray (10YR 6/2) sand; single grained; loose; few fine roots; neutral; clear boundary.

C2—25 to 70 inches; light gray (10YR 7/2) sand; few very pale brown strata of sand 2 to 5 millimeters thick; single grained; loose; few fine roots; neutral.

Texture is sand or fine sand. Reaction is medium acid to neutral. Quartz pebbles less than 1/2 inch in diameter comprise less than 2 percent. The A horizon is very dark gray, very dark grayish brown, dark gray, or dark grayish brown. It is 4 to 9 inches thick. The C horizon is light brownish gray, light gray, white, pale brown, or very pale brown.

Waller Series

The Waller series consists of deep, poorly drained, slowly permeable soils in shallow depressed areas in the southern Coastal Plain. They formed in thick beds of unconsolidated loam, silt loam, and clay loam sediment. Slope ranges from 0 to 1 percent.

Typical pedon of Waller silt loam, 0 to 1 percent slopes; from the intersection of U.S. Highway 190 and Farm Road 350 about 2 miles west of Livingston, 4.7 miles south and west on Farm Road 350, 1.6 miles south on Farm Road 3126, and 500 feet northeast: in a pasture:

A—0 to 6 inches; grayish brown (10YR 5/2) silt loam; few fine faint mottles of brown along root channels; massive; very hard, friable; few fine roots flattened along cracks; crayfish krotovinas, black staining of organic matter along the sides, filled with very fine sand and silt; strongly acid; gradual wavy boundary.

Eg—6 to 35 inches; gray (10YR 6/1) silt loam; few fine faint yellowish brown and brownish yellow mottles and common streaks and masses of white silt loam; massive; very hard, friable; few fine roots flattened along cracks; crayfish krotovinas, black stainings of organic matter along the sides, filled with very fine sand and silt; very strongly acid; gradual wavy boundary.

Btg/E—35 to 46 inches; light brownish gray (10YR 6/2) clay loam; many medium and coarse distinct strong brown (7.5YR 5/6) mottles; weak and moderate coarse blocky structure; very hard, firm; few fine roots; few fine soft black deposits; thick silt coatings and patchy clay film on the faces of peds; common tongues of silt loam and loam and common krotovinas extend through this horizon; krotovina walls coated with clay film approximately 1 millimeter thick; strongly acid; diffuse wavy boundary.

Btg—46 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam; many medium and coarse distinct and prominent mottles of strong brown (7.5YR 5/6); weak coarse blocky structure; very hard, firm; few fine roots; patchy clay film on faces of peds; few fine gypsum crystals in the lower part; common pockets and tongues of silt loam, a few krotovinas filled with silt loam, side walls lined with clay; few fine soft black deposits; strongly acid.

The thickness of the solum ranges from 60 to more than 80 inches.

The A horizon is dark gray, dark grayish brown, gray, grayish brown, light brownish gray, or light gray. Reaction is medium acid to very strongly acid.

The Eg horizon is gray, light brownish gray, or light gray and has brownish or yellowish mottles in some pedons. The E horizon is silt loam, loam, or very fine

sandy loam. The lower part of the Eg horizon has vertical streaks of clean sand and silt that tongues into the Btg horizon. The tongues or crayfish krotovina are about 15 to 20 centimeters apart. They are 2 to 10 centimeters wide in the upper part of the Btg horizon and extend from 1 to 5 centimeters. Large rounded clay flows are in the lower part.

The Btg horizon is gray, light gray, or light brownish gray and has mottles of strong brown, reddish yellow, or red. Texture is loam, clay loam, or silty clay loam. Reaction is medium acid through very strongly acid. Gypsum crystals are in most pedons. The Btg/E horizon is gray, light gray, or light brownish gray and has mottles in shades of yellow and brown. The Btg part of this horizon is mainly loam or clay loam. The E part is mainly loam, silt loam, or very fine sandy loam.

Wiergate Series

The Wiergate series consists of deep, somewhat poorly drained, very slowly permeable soils on sloping uplands. They formed in weakly consolidated, calcareous, clay and marl. Slope ranges from 1 to 8 percent.

Typical pedon of Wiergate clay, 5 to 8 percent slopes; from Moscow, 4.2 miles west on Farm Road 350, and 50 feet south; in a pasture:

A—0 to 12 inches; very dark gray (10YR 3/1) clay; moderate medium subangular blocky structure and strong fine granular structure; very hard, very firm; few medium and fine roots; about 2 percent, by volume, pitted concretions of calcium carbonate; mildly alkaline; clear wavy boundary.

Bw1—12 to 36 inches; olive gray (5Y 5/2) clay; few medium distinct pale olive mottles; strong medium angular blocky structure; extremely hard, very firm; few fine and medium roots; few slickensides; about 2 percent, by volume, pitted concretions of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

Bw2—36 to 60 inches; pale olive (5Y 6/3) clay; many fine prominent yellowish brown (10YR 5/6) and yellow (10YR 7/6) mottles; moderate medium angular blocky structure; extremely hard, very firm; many large intersecting slickensides, parallelepipeds long axes tilted about 45 degrees from the horizontal; about 4 percent, by volume, pitted concretions of calcium carbonate; calcareous; moderately alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. Gilgai relief ranges from 4 to 15 feet between the center of the microknoll and the center of the microdepression with highs 2 to 12 inches above the lows. Depth to intersecting slickensides ranges from 15 to 36 inches. The control section averages 60 to 80 percent clay content.

The A horizon ranges from 2 inches thick on the microhigh to 36 inches thick in the microlow and is more than 12 inches thick in most of the pedon. The A horizon is very dark gray or black. Pitted concretions of calcium carbonate range from none to few. Reaction ranges from slightly acid to mildly alkaline.

The Bw horizon has colors that are variable but mainly are in shades of gray, olive, and yellow. Mottles in shades of yellow, brown, gray, and olive range from few to many. Concretions of calcium carbonate that are mostly pitted in the upper part are few or common. Soft masses of calcium carbonate range from none to few in the lower part of this horizon. Intersecting slickensides are common or many and are a few inches to a few feet across.

Woodville Series

The Woodville series consists of deep, somewhat poorly drained, very slowly permeable soils on uplands in the Coastal Plain. They formed in thick beds of unconsolidated, clayey sediment of Miocene age. Slope ranges from 1 to 12 percent.

Typical pedon of Woodville fine sandy loam, 1 to 5 percent slopes; from intersection of U.S. Highway 190 and U.S. Highway 59 in Livingston, 5.5 miles west on U.S. Highway 190, 2 miles west on Farm Road 2457, 400 feet north, and 3,200 feet northwest; near old tram roadbed:

A—0 to 3 inches; brown (10YR 5/3) fine sandy loam; weak fine granular structure; soft, friable; many fine roots; medium acid; abrupt wavy boundary.

E—3 to 6 inches; pale brown (10YR 6/3) fine sandy loam; weak fine granular structure; soft, friable; many fine medium and coarse roots; strongly acid; abrupt wavy boundary.

Bt1—6 to 9 inches; brown (7.5YR 5/4) clay; common fine and medium distinct red (10R 5/6) and gray (10YR 5/1) mottles; moderate medium subangular blocky structure; very hard, firm; common fine roots; few intersecting slickensides; many pressure faces; very strongly acid; clear wavy boundary.

Bt2—9 to 34 inches; mottled light gray (10YR 6/1), yellowish brown (10YR 5/6) and brownish yellow (10YR 6/6) clay; moderate fine and medium angular blocky structure; very hard, very firm; few medium and coarse roots; few intersecting slickensides; many pressure faces; strongly acid; gradual wavy boundary.

Bt3—34 to 46 inches; light gray (10YR 6/1) clay; common medium prominent dark red (10R 3/6) and yellowish brown (10YR 5/6) mottles; strong fine and medium angular blocky structure; extremely hard, very firm; few fine roots; few intersecting slickensides; strongly acid; diffuse wavy boundary.

Bt4—46 to 65 inches; light gray (10YR 7/1) clay; common medium prominent strong brown (7.5YR 5/6) and brownish yellow (10YR 6/8) mottles; strong fine angular blocky structure; very hard, very firm; few slickensides; strongly acid; diffuse irregular boundary.

BC—65 to 70 inches; light gray (10YR 7/1) clay; few medium prominent dark red (10R 3/6) and common brownish yellow (10YR 6/8) mottles; moderate medium and coarse blocky structure; very hard, very firm; moderately alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. Content of clay ranges from 40 to 60 percent in the upper 20 inches of the argillic horizon and has COLE in excess of 0.09. Potential linear expansion is more than 6 centimeters.

The A horizon is very dark grayish brown, dark grayish brown, grayish brown, brown, or dark brown. It ranges from 3 to 7 inches thick. Reaction ranges from very strongly acid to slightly acid.

The E horizon is dark grayish brown, grayish brown, light brownish gray, light gray, very pale brown, pale brown, brown, or dark brown. It ranges from 2 to 9 inches thick.

The Bt1 horizon is red, reddish brown, yellowish red, reddish yellow, brown, or strong brown and has few to common mottles in shades of gray, brown, yellow, and red. The amount of gray increases with depth. Reaction is very strongly acid or strongly acid.

The lower part of the Bt horizon is typically mottled in shades of gray, red, and brown or has a matrix in shades of brown, gray, or yellow that has common or many mottles in shades of red, yellow, and brown. Reaction is very strongly acid or strongly acid.

The BC horizon has colors mainly in shades of gray. It is mottled in red, yellow, brown, and olive. Reaction is mainly strongly acid to slightly acid, but ranges from strongly acid to moderately alkaline. Some pedons contain pitted concretions of calcium carbonate.

Formation of the Soils

In this section the factors of soil formation are described as they relate to the soils in the survey area. The processes of soil formation are explained.

Factors of Soil Formation

Soil is a three-dimensional body on the earth's surface that supports plants. Properties of the soil result from the parent material and from additions, removals, transfers, and transformations caused by climate, living organisms, topography, and time. Also important are the cultural environment and man's use of the soil.

The interaction of the five soil-forming factors results in differences among the soils. Climate and plants and animals are the active factors. They act on the parent material through the weathering of rocks and through subsequent transportation by water and wind; they slowly change it into a natural body with genetically related horizons. The effects of climate and plants and animals are conditioned by topography. Soils on flood plains, for example, are quite different from those on well drained uplands. The parent material also affects the kind of profile that can form and sometimes determines it entirely. Finally, time is needed to change parent material into soil. Generally, a long time is needed for distinct horizons to form.

Parent Material

Parent material is the unconsolidated mass from which soil is formed. It determines the limits of the chemical and mineralogical composition of the soil. In Polk and San Jacinto Counties, the soils formed from parent material of Quaternary and Tertiary geologic ages.

Pinetucky and Doucette soils formed in loamy material, which permits moderate water movement. These soils have clay-enriched horizons that contain concretions of iron. Burkeville and Wiergate soils formed in calcareous, clayey material. The churning of this clay prevents differentiation of horizons. The parent material in the survey area is described in more detail in the surface geology section.

Climate

Polk and San Jacinto Counties have a warm, moist, humid, subtropical climate that is characterized by heavy rains. Summers are hot and humid. Winters are mild. Seasonal changes are gradual.

The climate under which the soils formed greatly influenced their development. The high humidity and rainfall caused most of the loamy soils on uplands to be strongly weathered, leached, and acidic. Therefore, most of the soils in the survey area are deep. Most of the differences between the soils, however, cannot be attributed to the climate because it has always been relatively uniform throughout the survey area.

Living Organisms

Plants, burrowing animals, earthworms, microorganisms, and human civilization have directly influenced the formation of soils.

Soils that form under trees accumulate organic matter in the upper few inches. This is quickly destroyed, however, when the soils are cultivated, as has happened in most cultivated areas of Pinetucky fine sandy loam, 1 to 5 percent slopes.

Earthworms, crayfish, and burrowing rodents help mix the material within the soil. Earthworms are numerous. They enhance the movement of air, water, and plant nutrients in these soils. Crayfish are most numerous in soils that have clayey layers and slow runoff. The crayfish bring soil material from the lower layers to the surface. Burrowing animals, such as gophers, help mix and aerate loamy soils, such as the Bernaldo and Pinetucky soils.

Topography

Relief affects the formation of soils by influencing drainage, infiltration, and plant cover. It strongly influences how much water percolates through the soil. For example, the strongly sloping Bonwier soils have a thinner solum than the nearby, gently sloping Pinetucky soils. This is because water runs off faster from the steeper slopes, less moisture infiltrates into the soil, and the plant cover is thinner.

Most of the soils are nearly level to strongly sloping, but shallow soil development as a result of relief is not pronounced in Polk and San Jacinto Counties. The abundant rainfall and long warm periods have overcome most of this effect. Nearly all the soils are deep.

Relief also influences soil drainage. Soils on nearly level surfaces have poor drainage. Sorter and Waller soils formed in these areas.

Time

The length of time that climate, living organisms, and relief act upon the parent material affects the kind of soil that forms. The effects of time are modified by the other four factors of soil formation. In general, however, soils that have no definite horizons are young or immature. Soils that have well defined horizons are old or mature.

In Polk and San Jacinto Counties the soils range from young to old. Kian, Mantachie, and Ozias soils are on flood plains and show faint horizons, if any. But, Conroe and Pinetucky soils on the uplands are mature soils that have distinct horizons that show little resemblance to the original parent material.

Processes of Horizon Differentiation

Several processes are involved in the formation of horizons in soils: accumulation of organic matter, leaching of carbonates and other bases, reduction and transfer of iron, and formation and translocation of silicate clay minerals. In most soils, more than one of these processes have been active in the development of a horizon.

Accumulation of organic matter in the upper part of a profile forms a distinct dark surface layer, such as Kaman and Wiergate soils. The soils in Polk and San Jacinto Counties range from low to medium in content of organic matter.

Carbonates have been leached downward in most of the soils in this area. Much leaching has occurred in most soils, but little has occurred in Wiergate soils that are still high in carbonates.

Reduction and transfer of iron, a process called gleying, is evident in the poorly drained and somewhat poorly drained soils. Gray colors in the lower layers of Sorter and Waller soils indicate reduction and loss of iron. Yellowish brown, strong brown, and reddish brown mottles and concretions in some horizons indicate segregation of iron. Pinetucky and Doucette soils have such mottles, and Conroe soils have nodules of ironstone.

The translocation of clay minerals has also contributed to horizon development in many soils in Polk and San Jacinto Counties. Clay minerals are the product of weathering of primary minerals. The subsoil in many soils has accumulations of clay or a clay film in pores and on the faces of peds. These soils were probably leached of carbonates and bases before the translocation of silicate clay took place. A horizon with accumulations of translocated clay is called an argillic horizon. Pinetucky and Woodville soils, for example, have an argillic horizon.

Surface Geology

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Polk and San Jacinto Counties, Texas, are in the West Gulf Coastal Plain geomorphic province *(12)*. Most of the formations crop out in broad, gulf-paralleling, northwest trending bands and dip gently gulfward. The parent material of the soils range in age from less than 3,000 years (Holocene alluvial) to more than 55 million years (Wellborn Formation of Eocene age).

The two-county area includes parts of the drainage basins of three streams that discharge into the Gulf of Mexico, the Trinity River that drains the central and major part of the survey area, the East Fork of the San Jacinto River that drains the southwestern part of San Jacinto County; and the Neches River that drains the northeastern and southeastern parts of Polk County.

The general soil map can serve as an approximate guide to the geology of the counties and can aid in grouping the soils into age and formational categories, as summarized in table 20 . Reference will be made to the most recent geologic maps of the area, to the relevant sheets of the Geologic Atlas of Texas *(21, 22)*, and to other local and regional studies.

Several regional geomorphic features are expressed in the area: the alluvial valley of the Trinity River, the Hockley Scarp, and the Kisatchie Wold. The broad, alluvial valley of the Trinity River and its flanking stairstep terraces are underlain, respectively, by soils of the flood plains and terraces of the general soil map.

The Hockley Scarp, a pronounced break in slope, extends westward from the Sabine River in east Texas, passes through the community of Hockley in Harris County, and then extends southward. The scarp marks the approximate boundary between the older Willis Formation and the younger Bentley or Lissie Formation. Locally the scarp follows the boundary between the Pinetucky-Doucette and Conroe general soil map units on uplands and the Otanya-Kirbyville-Dallardsville and the Sorter-Otanya-Waller general soil map units on the flatwoods.

The Kisatchie Wold, or cuesta or escarpment, is a ridge that is held up by a group of resistant Tertiary formations *(8)*. This ridge enters Texas from Louisiana and continues southwestward past the Brazos River. The ridge is the cause of the almost eastward deflection of the Neches River in the northernmost part of Polk County. Piney Creek, an eastward flowing tributary to the Neches River in the northern part of Polk County, also flows parallel to the strike of the formations that make up the escarpment. The east-west trend of the Laska-Colita-Oakhurst, the Diboll-Moswell-Keltys, and the Moswell-Keltys general soil map units also reflect the strike of these formations.

For purpose of discussion, the geologic units will be grouped into the following categories: the members of

the middle and upper part of the Jackson Group: the Wellborn, Manning, and Whitsett Formations; the Catahoula Formation; the Fleming Formation; the Willis Formation; the Bentley Formation, or lower or older part of the Lissie Formation; and post-Bentley stream terraces and Holocene alluvium.

The formations of the Jackson Group and the Catahoula, Fleming, Willis, and Bentley Formations crop out in broad east-west to northeast-southwest trending bands that determine the major patterns of the general soil map. The Beaumont Formation, the Deweyville terraces, and most of the Holocene alluvium soils on stream terraces and bottom lands or on flood plains, as shown in table 20, have a southeastward trend, down the regional slope, and are roughly perpendicular to the strike or trend of the older units. The major exception is the alluvium soils, the Kian-Mantachie and Pophers-Ozias general soil map units respectively, along the Neches River and Piney Creek. The map patterns of these terrace and flood plain deposits indicate the direction of the deposition of these sediments. In the older formations, the depositional directions, as opposed to strike or trend of their outcrops, were deposited roughly in the same direction, for example, in a south or southeastward direction, but the directions can be seen only by tracing out sand bodies in the units.

Jackson Group

The middle and upper Wellborn, Manning, and Whitsett Formations of the upper Eocene Jackson Group, make up the parent material of the Diboll-Moswell-Keltys and the Moswell-Keltys general soil map units, which are in the extreme northeast and northwest parts of the survey area. The soil series in the Diboll, Herty, Keltys, and Moswell map units have developed on these formations. Bedrock or rock fragments are encountered in some or all of the profiles of these soils. The formations constitute a regressive sequence *(9)*, that is, one representing an advancing shoreline or a retreating sea in which, for example, a fluvial deposit of the Whitsett Formation overlies a deltaic deposit of the Manning Formation, which in turn overlies a near shore shallow marine deposit of the Wellborn Formation. Thus, the sands in these formations locally may be fluvial channel and point bar, or delta distributary, or delta front respectively; the shales, flood basin, interdistributary, or delta front, respectively. In particular, the Keltys and Diboll series have developed in sandstone and the Herty and Moswell series have developed on shale. All of the formations contain lignitic sediment or lignite beds deposited in the several environments. Also, all of the formations, especially the Whitsett Formation, contain some volcanic ash (tuff) or weathered volcanic ash (bentonite). The Manning and the Wellborn Formations contain minor amounts of glauconite, a green iron silicate indicative of marine environments.

Many of the sola contain siliceous pebbles of uncertain origin that will be discussed in the section on the Willis Formation.

Catahoula Formation

The Catahoula Formation of late Oligocene age to early Miocene age is almost coextensive with the Laska-Colita-Oakhurst general soil map unit in which the Laska, Colita, Oakhurst, Kitterll, and Rayburn series are found. The Catahoula Formation and its attendant soils crop out in a band 2 1/4 to 6 miles in width across northern Polk and San Jacinto Counties. Its absence on the geologic map *(22)* in San Jacinto County is probably an error.

This formation is the most bentonitic and tuffaceous of the Tertiary formations in east Texas and represents the culmination of a rain of volcanic ash beginning in the Eocene age, and continuing through the Oligocene age and part of the Miocene age. The ash was blown in from sources in northwestern Mexico, New Mexico, and Trans-Pecos Texas *(10)*. The Catahoula Formation is largely fluviatile in origin and continues the regressive or outbuilding of the shoreline noted in the Jackson Group. The lithologies include channel and point bar sandstones and levee and crevasse splay sandstones, siltstones, and mudstones. All of these contain volcanic ash either as weathered bentonitic clays, in place or reworked, or as reworked volcanic ash. Lacustrine deposits may contain unreworked volcanic materials *(10)*.

Again, siliceous pebbles, apparently unrelated to the parent materials of the several soils of the Catahoula Formation general soil map units are found in the upper parts of the soil profiles.

Fleming Formation

The formation overlying the Catahoula Formation is the Fleming Formation of a Miocene age, which in the survey area is largely fluviatile in origin *(6)*. However, to the east, outside the survey area in Newton County, deltaic and brackish-water marine sediments occur *(16)*. The formation consists of calcareous clay and silt of flood basin and levee origin and of calcite-cemented, crossbedded sandstone of channel and point bar origin. The clayey parts of the Fleming Formation contain many calcareous concretions and calcite-cemented caliche fragments of nonpedogenic origin, thought to be detritus derived from the erosion contemporaneous or older caliche deposits. Siliceous gravels contemporaneous with the fluvial sediments seem to be absent.

The vertisolic or vertic Burkeville, Weirgate, Woodville soils, and in some places the Garner soils, have the clayey parts of the Fleming Formation as parent material, mainly in the Weirgate-Burkeville-Woodville general soil map unit. The Woodville soil is acid and contains no calcareous concretions, but towards the bottom of the profile, it becomes alkaline and may be the product of the deep solution or leaching out of calcium carbonate.

The Garner soils are generally confined to the Beaumont age terraces along the Trinity River but have been mapped occasionally with the other vertisols or vertic soils. Perhaps most, if not all of the Fleming Formation outcrop was at one time covered with the younger, stratigraphically higher Willis Formation that is now represented by the Pinetucky soil on hilltops and side slopes of the Wiergate-Burkeville-Woodville general soil map unit. The large areas of Fleming Formation outcrop shown on the geologic map *(22)* cannot readily be discerned in the field and are represented on the general soil map by the Woodville-Pinetucky general soil map unit. The area of this map unit, upon further erosion and removal of Willis Formation cover, would probably yield more extensive outcrops of the clayey, calcareous Fleming Formation, now manifested only by the Woodville soils whose upper solum is a sandy, locally pebbly Willis Formation residuum, and whose lower, more vertic solum, is deeply leached, noncalcareous Fleming Formation clay.

The Willis Formation does not uniformly occupy hilltop positions. In some places, the calcareous Fleming Formation derived soils are topographically higher. The reasons for this are that the Willis Formation, fluviatile in origin, was probably initially deposited on a channeled, eroded or unconformable Fleming surface with the Fleming Formation for a time occupying locally the higher topographic positions. Later the Fleming Formation interfluves would be buried by continued Willis Formation deposition. Upon erosion of the Willis Formation, these Fleming Formation "highs" would be exhumed. In addition, some Willis Formation in lower topographic positions may be mass-wasted deposits from higher elevations that moved downslope upon dissection of the landscape, and then recemented by iron oxides.

Willis Formation

The Willis Formation is the most extensive area of the local geologic units and includes most of the Woodville-Pinetucky, Pinetucky-Doucette, and Conroe general soil map units. Almost restricted to Willis Formation parent material are the Betis, Boykin, Choates, Conroe, Doucette, Leggett, Pinetucky, Stringtown, and Woodville soil series. Thirteen map units derived from these series.

The age of the Willis Formation is in dispute because of the absence of both diagnostic fossils and volcanic ash deposits. Some components of these deposits may be radiometrically dated. Conjectures concerning the place of the Willis Formation in the geologic column have ranged from upper Pliocene, Plio-Pleistocene, early preglacial Pleistocene, to early Pleistocene contemporaneous with worldwide glaciation. Based on the probable correlation of the Willis Formation with the Citronelle Formation, which extends from Louisiana to western Florida and where it may merge with a fossiliferous marine deposit, a Plio-Pleistocene age seems reasonable *(13)*. With the starting of the Pleistocene age over 2 1/2 million years ago *(4)*, parts of the Willis Formation may be about 3 million years old.

The Willis Formation is fluviatile in origin and includes many crossbedded and horizontally-bedded sand, and sand and gravel deposits of channel and point bar origin, as well as sandy and silty clay of overbank origin, or levee and flood basin. The lack of well sorted clays suggests deposition by streams deficient in suspended load, as opposed to the high suspended loads of streams depositing the Fleming Formation. Very coarse sand-size rounded and chiplike clasts of clay can be seen in some better preserved Willis Formation exposures. These were derived from the erosion of older or contemporaneous deposits. The puzzling and common occurrence of gravel in an unbedded clayey matrix in the Willis Formation may be the result of the breakdown of these clayey clasts by the weathering and mass-wasting processes. In deep road cuts and in sand and gravel pits, the Willis Formation can be pigmented and cemented by reddish, brownish, and purplish ferric iron oxides to a depth, in some places, of more than 12 feet. In some series, soil sola end in a B horizon at a depth of 80 inches. Considering the great depth of weathering indicated by iron oxide formation, it is likely that these sola may actually be forming in fossil soil material of great thickness, possibly of lateritic or oxisolic origin.

The absence of bedding and the occasional obvious distortion of bedding may in some places be the product of plinthite formation and the disruptive or expansive effects of the formation of hydrous iron oxides. The loss of bedding may also be related to erosional dissection of the Willis Formation, which may provide the slope necessary for down slope mass-wasting effects and attendant destruction of bedding. Upper slope material thus mobilized and relocated might later be stabilized and cemented or recemented by iron oxides.

Willis Formation residue in the form of thin beds of sands and gravels, or simply reddish, leached, noncalcareous clayey and silty material, cover most of the outcrop area of the Fleming Formation. The presence of the Fleming Formation in the lower part of the soil sola or parent material may be manifested only by the vertic subsoil properties or an increase in alkalinity.

The variety of fluvial materials, the possible presence of thick fossil oxisols or laterites, the range of available slopes resulting from erosional dissection, the effects of mass-wasting, the proximity of the underlying Fleming Formation, and the probable eolian reworking of some surface sands all contribute to the large number of soil series and map units of the Willis Formation outcrop area.

Many of the individual exposures of soil profiles developed on formations older than the Fleming Formation, such as the Catahoula Formation and those

of the Jackson Group, as seen in road cuts, excavations, and stream cuts display siliceous gravel up to 3 inches across either within the A horizon or along the contact between the A and B horizons. The base of the A horizon, or contacts between the map units in the A horizon, are often well defined by a clear or abrupt boundary. The gravel in many places is only one pebble thick. These gravel occurrences look like the classic "stone lines" described from many places in the world *(11, 15)*. Stone lines indicate that the material above and below the gravel is not genetically related. Some stone lines, such as on glacial tills, result from the removing of the finer material and the concentrating of coarse material by sheet or rill erosion or wind deflation and their later covering by water or by wind-laid sediment. In other stone lines, the gravel is not related to the material either above or below and is derived from upslope sources or from now vanished superincumbent sedimentary layers that are not like those below. The stone lines in the local soil profiles are examples of genetic independance of all units. Detailed lithologic descriptions of the several local formations *(14)* reveal no gravel in the parent material. The gravel is undoubtedly the remnant of an extensive Willis Formation cover and represents the end product of the removal of several portions, measuring from 10 to 100 feet of both Willis Formation and underlying older formations. The sandy material above the stone lines were laid down by water descending slopes or by eolian transport.

Bentley Formation

The Bentley Formation immediately overlies and is gulfward of the Willis Formation. On some geologic maps *(23)* the Bentley Formation is considered the lower part, or the older part, of the Lissie Formation, a unit used on the Geologic Map of Texas *(7)*. The younger part, or the upper part, of the Lissie Formation has been mapped *(22)* as the Montgomery Formation, a unit that is absent in Polk and San Jacinto counties, but is in nearby Montgomery, Liberty, and Hardin Counties. The reasons for the nomenclatural problem include the difficulty in distinguishing the Bentley Formation from the Montgomery Formation, and the belief of some geologists that only one formation, the Lissie Formation actually exists. This dispute has some consequences in the interpretation of the geologic history of this part of Texas.

The Bentley Formation is the oldest of the unequivocally Pleistocene age or "Ice Age" formations and its deposition was probably influenced by large-scale changes in sea level during the last 2 1/2 million years, during which continental glaciers advanced and retreated. Again, in the absence of fossils and radiometrically datable material, the age of the Bentley Formation can only be estimated as several hundred thousand years.

The soils developed in the Bentley Formation are principally confined to the Otanya-Kirbyville-Dallardsville and the Sorter-Otanya-Waller general soil map units on the flatwoods. The Dallardsville, Kirbyville, Otanya, Sorter, Splendora, and Waller soil series are more or less characteristic of the Bentley Formation lithologies and topography. The small number of map units and some other factors show the lack of erosional dissection and flatness of the terrain, the lack of complicating residual covers of older formations, and a kind of "homogenization" of the surface material in the past few hundred thousand years.

The Bentley Formation, like most of the older formations in Polk and San Jacinto counties has a fluviatile origin. A common view of geologists *(3)* is that the extensive area of Pleistocene formations, such as the Bentley Formation, were deposited during the interglacials, or episodes of high sea level similar to the present that separated major expansions of continental ice sheets. These formations were regressive or land-advancing units subsequent to the flooding or transgressing of the continental shelves previously exposed during times of low sea level. The dropping of sea level resulted from the abstraction or incorporation of water from oceanic sources into glaciers on the land areas. The deposition of the Bentley Formation was probably similar to that of the modern or Holocene alluvial plains of the Brazos River and Rio Grande after the most recent rise of sea level from a low of perhaps 300 feet below sea level about 18,000 years ago.

The surface of the Bentley Formation, unlike the surfaces of the younger Pleistocene Age formations, such as the Beaumont Formation, Brazoria, Harris, and Chambers Counties, and the Holocene surfaces of the Brazos River and Rio Grande alluvial plains, do not display surface fluvial depositional topography of channel, point bar, delta distributary, and overbank origin. The main surface patterns on the Bentley Formation are rather amorphous distributions of soil series and soil map units such as the Sorter and Waller series that vary from flat or very gently sloping to the broader, most sloping surfaces underlain by the Otanya series. The original surface depositional patterns were probably obliterated by a combination of the effects of wind deflation and accumulation, rill and sheet flood erosion, and small scale but cumulatively effective windthrows and similar disturbance in intermittently forested areas in the past few hundred thousand years.

The Bentley Formation surface has two small-scale geomorphic features —flatwood ponds and pimple mounds— that localize and characterize some soil series and soil map units. The flatwood ponds are shallow and intermittently dry and mapped in many places as Waller silt loam. They are elliptical to round in ground plan, rarely more than 1,000 feet in diameter, and they are generally in the flatter areas of Sorter and Kirbyville soils. In the more dissected areas, especially in the southwest

parts of the Sorter-Otanya-Waller general soil map unit in San Jacinto County, they are located in the flatter, plateaulike areas between shallow drains. In a few places, they are located on the slopes of broad drains. This latter occurence suggests a time of origin after the slight erosional dissection of the surface. Regardless of their origin they seem at the present time to be in a filling rather than excavational phase, with the Waller soil as a "cumulative" soil.

A 'blowout" or wind deflationary hypothesis for their origin is the best explanation. Under this suggestion, rims of wind-excavated material are absent from the edges of ponds, but these have probably been scattered and incorporated into the A horizon of the surrounding soil. Other explanations for the origin of the flatwood ponds including piping or subsurface erosion are unsupportable. This is because the soluble material has been removed, or inheritance of relict swales from an original fluvial surface pattern do not seem applicable.

Pimple mounds on the Bentley surface are mainly on the Otanya soils, and, to a lesser extent, on the Dallardsville soils. The mounds, or microknolls, are from about 50 to 100 feet in diameter, round to elliptical in ground plan, and less than 3 feet high. They are less well defined than mounds on the surfaces of the younger Beaumont and Montgomery Formations in adjacent Liberty and Hardin Counties. They merge areally into surrounding, somewhat undulating microtopography. On the younger surfaces, the relief of the mounds generally represents a thickening of the sandy and loamy A horizon. The Otanya and Dallardsville mounds do not necessarily show such a thickening; the clayey, lower part of sola can rise under the mounds and be depressed in the intermound areas of soils, such as the somewhat poorly drained Kirbyville series.

Mounds that are similar to pimple mounds are called mima mounds outside of the Gulf Coast of Texas and Louisiana. These mounds are almost exclusively west of the Mississippi River, including areas in Arkansas, Minnesota, Colorado, Washington, and California. Theories of origin have spawned extensive literature *(5)* and include their generation as residual material left after sheet or wind erosion; accumulations of wind transported sand, silt, and clay chips around clumps of vegetation (similar to the coppice mounds of arid and semiarid regions); wind accumulations that were initiated by or topographically enhanced by erosional processes; and changes in bulk density of the soil material, which was "fluffed up" or lowered by burrowing animals in concentrated areas with the possibility of additional increments by eolian action.

The relationship of the poorly defined Bentley mounds to the better defined ones on the younger surfaces is uncertain. The mounds on the older Bentley surface can be in a degrading or dispersal phase in contrast with the more stable mounds on the younger surfaces.

Post-Bentley Stream Terraces and Holocene Alluvium

Before Lake Livingston was filled, numerous low-level terraces, 10 to 25 feet above alluvium in which the present-day Trinity River flowed, were exposed. These can be seen on older U.S. Geological Survey topographic maps of the area. In places, these terraces displayed point bars or ridged accretions on the inside of meander mends. The radii of curvature was more than that of the present day Trinity River meanders. Some of these terraces merged, elevation-wise, into the Holocene alluvium. The large arcuate bay in Lake Livingston due south of Blanchard in Polk County, is a meander scar of similar large radius. Below the Lake Livingston Dam, features such as these can be seen in areas of the Bienville-Bernaldo-Spurger general soil map unit. Many sand and gravel pits have been opened in these terrace deposits, especially in Liberty County to the south. On the geologic map *(22)*, which was prepared prior to the filling of Lake Livingston, the now submerged deposits and the areas of the Bienville-Bernaldo-Spurger general soil map unit south of the dam were identified as the Deweyville Formation.

The small area of Bienville-Bernaldo-Spurger soils are surrounded by and are 10 to 30 feet higher than the Holocene alluvial deposits of the Neches River. These deposits are in the extreme northeast part of Polk County and also probably belong to the Deweyville Formation.

The Deweyville Formation occurs only as stream terraces. In this part of Texas, this formation has been dated by radiocarbon methods as being about 13,500 to 25,000 years in age. This spans part of the time interval between the last fall and rise of sea level because of worldwide continental glaciation. The coarse gravel and the large meander radii suggest more stream discharges, which were probably related to higher rainfalls during some phase of the glacial advance-and-retreat cycle.

The higher Trinity River stream terraces that remain exposed after the filling of Lake Livingston are represented by some areas of Garner and Bienville-Bernaldo-Spurger general soil map units that flank the lake. The flat areas of the Garner general soil map unit, especially those bounded by scarps facing the lake, are probably strath terraces. These terraces were cut by streams into the local bedrock, in this case the Fleming Formation. On the detailed soil maps the Garner soils surface, in some places, is continuous with or correlative in elevation with that of the Spurger soils and other terrace soils. The description of the Garner series indicates that part of that mapped as Garner soils has a loamy surface. This loamy surface material may be a thin fluviatile cover on the strath surface.

The isolated patch of Garner soils on the general soil map between Long King Creek and Tempe Creek, just west of Livingston, is of strath origin. It was separated

from the main terrace area by the headward erosion of Tempe Creek.

The Garner series occurs several times in hilly, obviously nonterrace areas, such as those about 1 mile south of Point Blank in San Jacinto County. These hilly areas are developed on the Fleming Formation and seem to have no relationship to fluvial erosion.

Most of the higher, flat areas of the Bienville-Bernaldo-Spurger general soil map units are also terraces that are underlain by fluviatile material. In some places, the pebble-free sandy and loamy surfaces of the soil of this map unit may indicate eolian reworking of surface terrace material.

The terraces that remained above lake level after Lake Livingston filled were identified on the geologic map *(22)* as belonging to the Beaumont Formation. The basis of this identification is mainly the projection of the Beaumont Formation's surface upstream from where it extends laterally as a coastal striking formation. This is similar to the Bentley series in Liberty and Hardin Counties to the south. The Beaumont Formation is of Pleistocene age and was deposited during a period of high sea level prior to the Deweyville Formation. The age of the Beaumont Formation has been variously estimated to be 30,000 to 120,000 years.

The Kaman-Hatliff-Nahatche, the Hatliff-Pluck-Kian, the Pophers-Ozias, and the Kian-Mantache general soil map units for the most part are of Holocene age. The few occurrences in these of the Bernaldo and Spurger soils are of Deweyville age and are either low-level terraces merging, with respect to elevation, with the flood plain deposits or distinctly higher but encircled, isolated remnants.

The varieties of parent material and their stratification reflect the great range in current velocities during the rising and falling stages of floods when most stream erosion and deposition occur. Differences also result from local, and more distant upstream variations in sources of erodible materials available to streams.

The time term "Holocene" has a variety of regional usages. On the Gulf Coast of Texas, it generally refers to post-Deweyville deposits that may be less than 12,000 years in age. Holocene especially refers to surfaces that are graded to present day sea level such as the flood plains of Polk and San Jacinto Counties. The last great glacially-induced lowering of sea level was about 18,000 years ago *(3)*. Sea level rose more or less continuously until about 3,000 to 3,500 years ago when it reached its present level.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). The volume of soft soil decreases excessively under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazingland for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods

during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic).—Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated).—Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, such as fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay are in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The movement of water into the soil is rapid.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant that is not a grass or a sedge.

Fragile (in tables). The soil is easily damaged by use or disturbance.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not

prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is, in part, a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as accumulation of clay, sesquioxides, humus, or a combination of these; prismatic or blocky structure; redder or browner colors than those in the A horizon; or a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Arabic numeral 2 precedes the letter C.

R layer.—Consolidated rock (unweathered bedrock) beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the plants that are the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material. This contrasts with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments that are 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Open space. A relatively undeveloped green or wooded area provided mainly within an urban area to minimize feelings of congested living.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Subsurface tunnels or pipelike cavities are formed by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plinthite. The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. It commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone

hardpan or to irregular aggregates on repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poor outlets (in tables). In these areas, surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of the acidity or alkalinity of a soil expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Rippable bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). There is a shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs the growth of plants. A saline soil does not contain excess exchangeable sodium.

Salty water (in tables.) Water is too salty for consumption by livestock.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05

millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slippage (in tables). The soil mass is susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium absorption ratio (SAR) of a saturation extract, or the ratio of Na^+ to $Ca^{++} + Mg^{++}$. The degrees of sodicity are—

	SAR
Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, thickness of the line can be one fragment or more. It generally overlies material that weathered in place, and it is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in organic matter content than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed on the contour or at a slight angle to the contour across sloping soils. The terrace intercepts surface runoff, so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). An excessive amount of toxic substances in the soil, such as sodium or sulfur, severely hinders the establishment of vegetation or severely restricts plant growth.

Trace elements. Chemical elements, such as zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Unstable fill (in tables). There is a risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced by atmospheric agents in rocks or other deposits at or near the earth's surface. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of course grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. This contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Based on data recorded in the period 1951-76 at Livingston, Texas]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	60.6	37.8	49.2	81	14	133	3.84	1.75	5.52	7	.2
February---	64.2	39.7	51.9	82	19	151	3.71	2.33	4.95	6	.6
March------	70.6	46.3	58.5	87	24	294	3.22	1.41	4.69	6	.0
April------	78.1	55.6	66.9	89	31	507	4.79	1.78	7.20	6	.0
May--------	84.2	62.4	73.4	93	42	725	4.65	2.44	6.45	6	.0
June-------	90.4	68.3	79.4	98	55	882	3.44	1.02	5.38	5	.0
July-------	93.7	71.1	82.4	103	63	1,004	3.93	2.33	5.36	6	.0
August-----	93.8	70.3	82.0	102	59	992	3.38	1.40	4.99	6	.0
September--	89.1	65.5	77.3	99	48	819	4.65	1.68	7.02	6	.0
October----	81.2	54.7	68.0	94	34	558	4.01	1.31	6.18	4	.0
November---	70.3	45.5	57.9	87	24	254	4.18	2.11	5.87	6	.0
December---	62.8	39.0	50.9	81	17	130	4.67	2.51	6.42	7	.0
Yearly:											
Average--	78.3	54.7	66.5	---	---	---	---	---	---	---	---
Extreme--	---	---	---	104	13	---	---	---	---	---	---
Total----	---	---	---	---	---	6,449	48.47	38.26	58.11	71	.8

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 °F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Based on data recorded in the period 1951-76 at Livingston, Texas]

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	March 18	March 25	April 7
2 years in 10 later than--	March 5	March 17	March 31
5 years in 10 later than--	February 8	March 2	March 19
First freezing temperature in fall:			
1 year in 10 earlier than--	November 13	October 29	October 25
2 years in 10 earlier than--	November 23	November 8	October 31
5 years in 10 earlier than--	December 13	November 25	November 13

TABLE 3.--GROWING SEASON

[Based on data recorded in the period 1951-76 at Livingston, Texas]

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	267	227	211
8 years in 10	279	241	221
5 years in 10	302	268	238
2 years in 10	331	295	256
1 year in 10	>365	309	265

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Polk County	San Jacinto County	Total--	
				Area	Extent
		Acres	Acres	Acres	Pct
BeB	Bernaldo fine sandy loam, 0 to 3 percent slopes	2,550	5,710	8,260	0.7
BeC	Bernaldo fine sandy loam, 3 to 8 percent slopes	1,700	280	1,980	0.2
BfB	Betis loamy fine sand, 1 to 5 percent slopes	4,550	1,400	5,950	0.5
BnB	Bienville loamy fine sand, 0 to 3 percent slopes	12,850	6,340	19,190	1.7
BoB	Boykin loamy fine sand, 1 to 5 percent slopes	10,500	5,180	15,680	1.4
BuD	Burkeville clay, 5 to 15 percent slopes	1,990	6,450	8,440	0.8
CaB	Choates loamy fine sand, 1 to 5 percent slopes	14,200	6,250	20,450	1.8
CfB	Colita fine sandy loam, 0 to 3 percent slopes	8,500	920	9,420	0.8
ClB	Colita-Laska complex, 1 to 5 percent slopes	36,960	70	37,030	3.3
CpC	Colita Variant-Kitterll complex, 1 to 8 percent slopes	1,860	660	2,520	0.2
CrB	Conroe gravelly loamy fine sand, 1 to 5 percent slopes	0	28,200	28,200	2.5
CrC	Conroe gravelly loamy fine sand, 5 to 8 percent slopes	0	550	550	0.1
DaA	Dallardsville loamy very fine sand, 0 to 2 percent slopes	17,500	5,790	23,290	2.1
DbB	Diboll silt loam, 0 to 3 percent slopes	2,350	0	2,350	0.2
DkB	Diboll-Keltys complex, 1 to 5 percent slopes	20,850	0	20,850	1.9
DoB	Doucette loamy fine sand, 1 to 5 percent slopes	38,250	29,700	67,950	6.1
Fa	Fausse clay, frequently flooded	280	1,100	1,380	0.1
GaA	Garner clay, 0 to 1 percent slopes	8,500	1,550	10,050	0.9
GaB	Garner clay, 1 to 5 percent slopes	6,100	1,800	7,900	0.7
Ha	Hatliff loam, rarely flooded	1,440	0	1,440	0.1
Hf	Hatliff loam, frequently flooded	19,200	7,850	27,050	2.4
HrB	Herty silt loam, 1 to 3 percent slopes	2,950	0	2,950	0.3
HrC	Herty silt loam, 3 to 5 percent slopes	2,290	0	2,290	0.2
Ka	Kaman clay, rarely flooded	1,180	8,500	9,680	0.9
Kf	Kaman clay, frequently flooded	4,050	6,500	10,550	1.0
KlB	Keltys very fine sandy loam, 1 to 5 percent slopes	3,550	0	3,550	0.3
KM	Kian and Mantachie soils, frequently flooded	33,500	820	34,320	3.1
KvA	Kirbyville fine sandy loam, 0 to 2 percent slopes	15,500	11,800	27,300	2.5
LaB	Laska fine sandy loam, 1 to 5 percent slopes	14,260	320	14,580	1.3
LgB	Leggett fine sandy loam, 0 to 3 percent slopes	18,500	10,950	29,450	2.7
MoB	Moswell fine sandy loam, 1 to 5 percent slopes	4,560	0	4,560	0.4
MoD	Moswell fine sandy loam, 5 to 12 percent slopes	12,450	0	12,450	1.1
Na	Nahatche fine sandy loam, rarely flooded	2,550	3,380	5,930	0.5
OaB	Oakhurst very fine sandy loam, 1 to 5 percent slopes	5,780	3,140	8,920	0.8
OaC	Oakhurst very fine sandy loam, 5 to 8 percent slopes	6,410	5,850	12,260	1.1
OtA	Otanya fine sandy loam, 0 to 3 percent slopes	23,500	11,700	35,200	3.2
Oz	Ozias-Pophers complex, frequently flooded	6,600	0	6,600	0.6
PaB	Pinetucky loamy fine sand, 1 to 5 percent slopes	6,750	1,050	7,800	0.7
PfB	Pinetucky fine sandy loam, 1 to 5 percent slopes	89,300	39,500	128,800	11.6
PGB	Pinetucky and Conroe soils, graded	980	4,380	5,360	0.5
PK	Pluck and Kian soils, frequently flooded	37,500	27,950	65,450	5.9
Pp	Pophers silty clay loam, frequently flooded	6,690	0	6,690	0.6
RaB	Rayburn fine sandy loam, 1 to 5 percent slopes	1,440	141	1,581	0.1
RaD	Rayburn fine sandy loam, 5 to 15 percent slopes	9,500	1,600	11,100	1.0
SoA	Sorter silt loam, 0 to 1 percent slopes	850	18,200	19,050	1.7
SpA	Splendora very fine sandy loam, 0 to 2 percent slopes	0	1,750	1,750	0.2
SrB	Spurger fine sandy loam, 1 to 5 percent slopes	4,190	2,200	6,390	0.6
SrD	Spurger fine sandy loam, 5 to 15 percent slopes	680	2,750	3,430	0.3
STE	Stringtown-Bonwier association, strongly sloping	30,150	13,500	43,650	3.9
Vr	Voss sand, rarely flooded	242	290	532	0.1
Vs	Voss sand, frequently flooded	1,210	1,320	2,530	0.2
WaA	Waller silt loam, 0 to 1 percent slopes	8,980	8,700	17,680	1.6
WgB	Wiergate clay, 1 to 5 percent slopes	8,650	3,700	12,350	1.1
WgC	Wiergate clay, 5 to 8 percent slopes	11,950	9,910	21,860	2.0
WoB	Woodville fine sandy loam, 1 to 5 percent slopes	30,500	18,000	48,500	4.4
WoD	Woodville fine sandy loam, 5 to 12 percent slopes	62,000	38,500	100,500	9.1
	Water	29,139	35,828	64,967	5.9
	Total	708,461	402,029	1,110,490	100.0

TABLE 5.--PRIME FARMLAND

[Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name]

Map symbol	Soil name
BeB	Bernaldo fine sandy loam, 0 to 3 percent slopes
CfB	Colita fine sandy loam, 0 to 3 percent slopes
ClB	Colita-Laska complex, 1 to 5 percent slopes
DaA	Dallardsville loamy very fine sand, 0 to 2 percent slopes
GaA	Garner clay, 0 to 1 percent slopes (where drained)*
GaB	Garner clay, 1 to 5 percent slopes
Ha	Hatliff loam, rarely flooded
Ka	Kaman clay, rarely flooded (where drained)*
KlB	Keltys very fine sandy loam, 1 to 5 percent slopes
KvA	Kirbyville fine sandy loam, 0 to 2 percent slopes
LaB	Laska fine sandy loam, 1 to 5 percent slopes
LgB	Leggett fine sandy loam, 0 to 3 percent slopes
Na	Nahatche fine sandy loam, rarely flooded
OtA	Otanya fine sandy loam, 0 to 3 percent slopes
PaB	Pinetucky loamy fine sand, 1 to 5 percent slopes
PfB	Pinetucky fine sandy loam, 1 to 5 percent slopes
SoA	Sorter silt loam, 0 to 1 percent slopes (where drained)*
SpA	Splendora very fine sandy loam, 0 to 2 percent slopes
SrB	Spurger fine sandy loam, 1 to 5 percent slopes
WaA	Waller silt loam, 0 to 1 percent slopes (where drained)*
WgB	Wiergate clay, 1 to 5 percent slopes

* The water table is maintained at a sufficient depth during the cropping season to allow cultivated crops common to the area to be grown.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to pasture]

Map symbol and soil name	Land capability	Bahiagrass	Improved bermudagrass	Common bermudagrass
		AUM*	AUM*	AUM*
BeB---------------------- Bernaldo	IIe	8.0	10.0	7.0
BeC---------------------- Bernaldo	IVe	6.0	8.0	7.0
BfB---------------------- Betis	IIIs	6.5	8.0	6.0
BnB---------------------- Bienville	IIs	8.0	10.0	7.0
BoB---------------------- Boykin	IIIs	7.0	9.0	6.5
BuD---------------------- Burkeville	VIe	2.5	4.0	3.5
CaB---------------------- Choates	IIIw	7.0	8.0	6.0
CfB---------------------- Colita	IIIw	6.0	7.0	5.5
ClB---------------------- Colita-Laska	IIIw	6.5	8.0	6.0
CpC---------------------- Colita-Kitterll	VIs	5.0	6.0	5.0
CrB---------------------- Conroe	IIIs	6.0	7.0	5.5
CrC---------------------- Conroe	VIe	5.0	6.5	5.0
DaA---------------------- Dallardsville	IIw	7.0	9.0	6.5
DbB---------------------- Diboll	IIIe	6.5	8.0	6.0
DkB---------------------- Diboll-Keltys	IIIe	6.5	8.5	6.5
DoB---------------------- Doucette	IIIs	7.0	9.0	6.5
Fa----------------------- Fausse	VIIw	---	---	---
GaA---------------------- Garner	IIIw	6.0	5.0	4.5
GaB---------------------- Garner	IVe	5.5	4.5	4.5

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF PASTURE--Continued

Map symbol and soil name	Land capability	Bahiagrass	Improved bermudagrass	Common bermudagrass
		AUM*	AUM*	AUM*
Ha----------------------- Hatliff	IIw	7.0	8.0	6.0
Hf----------------------- Hatliff	Vw	6.0	7.0	6.0
HrB---------------------- Herty	IIIe	6.0	6.0	5.0
HrC---------------------- Herty	IVe	6.0	6.0	5.0
Ka----------------------- Kaman	IIw	6.0	5.0	4.5
Kf----------------------- Kaman	Vw	4.0	3.0	2.5
KlB---------------------- Keltys	IIIe	7.0	9.0	6.5
KM----------------------- Kian and Mantachie	Vw	6.5	7.5	5.5
KvA---------------------- Kirbyville	IIw	8.0	10.0	7.0
LaB---------------------- Laska	IIw	7.0	9.0	6.5
LgB---------------------- Leggett	IIIw	6.0	6.0	5.0
MoB---------------------- Moswell	IVe	6.0	6.0	5.0
MoD---------------------- Moswell	VIe	5.0	5.0	4.0
Na----------------------- Nahatche	IIw	8.0	10.0	7.0
OaB---------------------- Oakhurst	IVe	5.0	5.5	5.0
OaC---------------------- Oakhurst	VIe	4.5	5.0	4.5
OtA---------------------- Otanya	IIe	8.0	10.0	7.0
Oz----------------------- Ozias-Pophers	Vw	6.0	7.0	5.5
PaB, PfB----------------- Pinetucky	IIIe	8.0	10.0	7.0
PGB---------------------- Pinetucky and Conroe	VIe	3.0	3.5	3.0

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF PASTURE--Continued

Map symbol and soil name	Land capability	Bahiagrass	Improved bermudagrass	Common bermudagrass
		AUM*	AUM*	AUM*
PK------------------------ Pluck and Kian	Vw	6.0	7.0	5.5
Pp------------------------ Pophers	Vw	7.0	8.0	6.0
RaB----------------------- Rayburn	IVe	6.5	7.0	5.5
RaD----------------------- Rayburn	VIe	5.5	6.0	4.5
SoA----------------------- Sorter	IVw	6.0	6.0	5.0
SpA----------------------- Splendora	IIw	6.0	7.0	5.5
SrB----------------------- Spurger	IIIe	7.0	8.0	6.0
SrD----------------------- Spurger	VIe	6.0	7.0	5.0
STE:				
Stringtown---------------	VIe	6.0	7.0	6.0
Bonwier------------------	VIe	5.0	6.0	4.0
Vr------------------------ Voss	IVw	6.0	6.0	5.0
Vs------------------------ Voss	VIw	---	---	---
WaA----------------------- Waller	IIIw	6.0	6.0	5.0
WgB----------------------- Wiergate	IVe	6.0	5.0	4.5
WgC----------------------- Wiergate	VIe	5.0	4.5	4.0
WoB----------------------- Woodville	IVe	6.0	6.0	5.0
WoD----------------------- Woodville	VIe	5.0	5.0	4.5

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
BeB, BeC----------- Bernaldo	1o7	Slight	Slight	Slight	Slight	Loblolly pine------- Shortleaf pine------ Sweetgum-----------	98 87 ---	Loblolly pine, slash pine, shortleaf pine.
BfB---------------- Betis	3s2	Slight	Moderate	Severe	Slight	Shortleaf pine------ Loblolly pine------- Longleaf pine-------	71 80 70	Loblolly pine, slash pine.
BnB---------------- Bienville	2s2	Slight	Moderate	Moderate	Moderate	Loblolly pine------- Longleaf pine------- Shortleaf pine------	90 80 85	Loblolly pine, slash pine.
BoB---------------- Boykin	2s2	Slight	Slight	Moderate	Moderate	Loblolly pine------- Shortleaf pine------ Longleaf pine------- Slash pine----------	92 76 --- ---	Loblolly pine, slash pine.
BuD---------------- Burkeville	5c3	Slight	Moderate	Severe	Slight	Loblolly pine------- Shortleaf pine------	56 50	
CaB---------------- Choates	2w8a	Slight	Moderate	Moderate	Moderate	Loblolly pine------- Shortleaf pine------ Longleaf pine------- Sweetgum----------- Southern red oak----	90 --- --- --- ---	Loblolly pine, slash pine.
CfB---------------- Colita	3w8a	Slight	Moderate	Moderate	Slight	Longleaf pine------- Loblolly pine------- Sweetgum----------- Southern red oak----	82 79 --- ---	Loblolly pine, slash pine.
ClB:								
Colita------------	3w8a	Slight	Moderate	Moderate	Slight	Longleaf pine------- Loblolly pine------- Sweetgum----------- Southern red oak----	82 79 --- ---	Loblolly pine, slash pine.
Laska-------------	2w8a	Slight	Moderate	Slight	Moderate	Loblolly pine------- Shortleaf pine------ Slash pine----------	90 80 90	Loblolly pine, slash pine.
CpC:								
Colita------------	5d3	Slight	Moderate	Severe	Slight	Loblolly pine------- Shortleaf pine------	60 50	Loblolly pine.
Kitterll----------	5d3	Slight	Moderate	Severe	Slight	Loblolly pine------- Shortleaf pine------	60 50	Loblolly pine.
CrB, CrC----------- Conroe	3s2	Slight	Moderate	Moderate	Slight	Loblolly pine------- Shortleaf pine------	78 66	Loblolly pine, slash pine.
DaA---------------- Dallardsville	2w8a	Slight	Moderate	Moderate	Moderate	Loblolly pine------- Shortleaf pine------ Water oak----------- Sweetgum----------- Southern red oak----	90 80 90 --- ---	Loblolly pine, slash pine.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Potential productivity: Common trees	Site index	Trees to plant
DbB----------------Diboll	3w9	Slight	Moderate	Severe	Moderate	Loblolly pine------- Shortleaf pine------ Water oak----------- Southern red oak---- Willow oak----------	80 70 --- --- 80	Loblolly pine, slash pine, water oak.
DkE:								
Diboll------------	3w9	Slight	Moderate	Severe	Moderate	Loblolly pine------- Shortleaf pine------ Water oak----------- Southern red oak---- Willow oak----------	80 70 --- --- 80	Loblolly pine, slash pine, water oak.
Keltys------------	2o7	Slight	Slight	Slight	Slight	Loblolly pine------- Shortleaf pine------ Sweetgum------------ Southern red oak----	90 80 --- ---	Loblolly pine, slash pine.
DoB----------------Doucette	2s2	Slight	Slight	Moderate	Moderate	Loblolly pine------- Shortleaf pine------ Longleaf pine-------	90 75 86	Loblolly pine, slash pine.
Fa-----------------Fausse	4w6	Slight	Severe	Severe	Moderate	Baldcypress--------- Water hickory------- Water tupelo-------- Black willow-------- Red maple-----------	--- --- --- --- ---	Baldcypress.
GaA, GaB-----------Garner	3w8b	Slight	Moderate	Moderate	Moderate	Loblolly pine------- Longleaf pine------- Shortleaf pine------ Southern red oak---- Willow oak---------- Sweetgum------------	80 70 --- --- --- ---	Loblolly pine, slash pine, longleaf pine.
Ha, Hf-------------Hatliff	2w8b	Slight	Moderate	Moderate	Moderate	Loblolly pine------- Slash pine---------- Sweetgum------------ Water oak----------- Willow oak----------	95 --- --- --- ---	Loblolly pine, slash pine, eastern cottonwood.
HrB, HrC-----------Herty	3c8	Slight	Moderate	Moderate	Moderate	Loblolly pine------- Shortleaf pine------ Water oak----------- Southern red oak---- Post oak------------	80 70 80 70 ---	Loblolly pine, slash pine.
Ka, Kf-------------Kaman	1w6a	Slight	Severe	Severe	Moderate	Baldcypress--------- Sweetgum------------ Water oak-----------	95 --- ---	Baldcypress.
KlB----------------Keltys	2o7	Slight	Slight	Slight	Slight	Loblolly pine------- Shortleaf pine------ Sweetgum------------ Southern red oak----	90 80 --- ---	Loblolly pine, slash pine.
KM:								
Kian--------------	2w9a	Slight	Severe	Moderate	Severe	Water oak----------- Sweetgum------------ Loblolly pine------- Southern red oak----	90 88 90 89	Sweetgum, loblolly pine.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Potential productivity: Common trees	Site index	Trees to plant
KM:								
Mantachie	1w9	Slight	Severe	Severe	Severe	Green ash	80	Green ash, eastern cottonwood, cherrybark oak, loblolly pine, sweetgum.
						Eastern cottonwood	90	
						Cherrybark oak	100	
						Loblolly pine	98	
						Sweetgum	95	
KvA: Kirbyville	1w8	Slight	Moderate	Slight	Moderate	Loblolly pine	105	Slash pine, loblolly pine.
						Shortleaf pine	---	
						Slash pine	98	
						Longleaf pine	---	
LaB: Laska	2w8a	Slight	Moderate	Slight	Moderate	Loblolly pine	90	Loblolly pine, slash pine.
						Shortleaf pine	80	
						Slash pine	90	
						Sweetgum	---	
LgB: Leggett	3w8a	Slight	Moderate	Moderate	Moderate	Loblolly pine	82	Loblolly pine, slash pine, sweetgum.
						Slash pine	---	
						Sweetgum	---	
MoB, MoD: Moswell	3c8	Slight	Moderate	Slight	Slight	Loblolly pine	80	Slash pine, loblolly pine.
						Shortleaf pine	70	
						Southern red oak	---	
						Sweetgum	---	
Na: Nahatche	1w9	Slight	Severe	Moderate	Slight	Water oak	100	Eastern cottonwood, water oak.
						Willow oak	100	
						Eastern cottonwood	100	
						Loblolly pine	100	
OaB, OaC: Oakhurst	4w9	Slight	Moderate	Severe	Moderate	Loblolly pine	70	Loblolly pine.
						Shortleaf pine	60	
						Water oak	---	
						Sweetgum	---	
OtA: Otanya	1o7	Slight	Slight	Slight	Slight	Loblolly pine	98	Loblolly pine, slash pine, sweetgum.
						Longleaf pine	96	
						Shortleaf pine	---	
						Sweetgum	---	
						Slash pine	97	
Oz:								
Ozias	1w6b	Slight	Severe	Severe	Moderate	Overcup oak	---	Water oak, willow oak.
						Water oak	100	
						Sweetgum	100	
						Winged elm	---	
						Green ash	---	
Pophers	1w6b	Slight	Severe	Severe	Moderate	Water oak	105	Water oak, green ash, sweetgum.
						Green ash	---	
						Sugarberry	---	
PaB, PfB: Pinetucky	2o7	Slight	Slight	Slight	Slight	Loblolly pine	95	Loblolly pine, longleaf pine, slash pine.
						Longleaf pine	82	
						Slash pine	---	
						Sweetgum	---	
PGB:								
Pinetucky	4c3	Severe	Moderate	Moderate	Slight	Loblolly pine	70	Loblolly pine.
						Shortleaf pine	---	

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
PGB:								
Conroe	4c3	Severe	Moderate	Moderate	Slight	Loblolly pine	70	Loblolly pine.
						Shortleaf pine	60	
PK:								
Pluck	2w9a	Slight	Severe	Severe	Severe	Water oak	90	Sweetgum, loblolly pine.
						Sweetgum	90	
						Loblolly pine	90	
Kian	2w9a	Slight	Severe	Moderate	Severe	Water oak	90	Sweetgum, loblolly pine.
						Sweetgum	88	
						Loblolly pine	90	
						Southern red oak	89	
Pp: Pophers	1w6b	Slight	Severe	Severe	Moderate	Water oak	105	Water oak, green ash, sweetgum.
						Green ash	---	
						Sugarberry	---	
RaB, RaD: Rayburn	2c8	Moderate	Moderate	Moderate	Moderate	Loblolly pine	87	Loblolly pine, slash pine.
						Shortleaf pine	80	
						Longleaf pine	74	
						Sweetgum	---	
SoA: Sorter	2w9b	Slight	Severe	Severe	Moderate	Loblolly pine	91	Loblolly pine, slash pine, sweetgum.
						Shortleaf pine	80	
						Longleaf pine	80	
						Water oak	90	
						Southern red oak	80	
						Sweetgum	90	
SpA: Splendora	2w8a	Slight	Moderate	Moderate	Moderate	Loblolly pine	94	Loblolly pine, slash pine, southern red oak.
						Shortleaf pine	80	
						Water oak	90	
						Sweetgum	90	
SrB, SrD: Spurger	1w8	Slight	Moderate	Slight	Moderate	Loblolly pine	101	Loblolly pine, slash pine.
						Shortleaf pine	---	
						Southern red oak	---	
						Sweetgum	---	
STE:								
Stringtown	3o1	Slight	Slight	Slight	Slight	Loblolly pine	76	Loblolly pine, slash pine.
						Longleaf pine	80	
Bonwier	4c2	Moderate	Slight	Slight	Slight	Loblolly pine	72	Loblolly pine, shortleaf pine.
						Shortleaf pine	61	
						Longleaf pine	65	
Vr, Vs: Voss	3s8	Slight	Moderate	Moderate	Slight	Loblolly pine	80	Loblolly pine, slash pine, eastern cottonwood.
						Shortleaf pine	70	
						Longleaf pine	70	
						Sweetgum	---	
						Water oak	---	
WaA: Waller	2w9b	Slight	Severe	Severe	Severe	Loblolly pine	80	Loblolly pine, slash pine.
						Water oak	80	
						Sweetgum	80	
						Shortleaf pine	70	
						Longleaf pine	70	
WgB, WgC: Wiergate	4c2	Slight	Moderate	Moderate	Moderate	Loblolly pine	70	Loblolly pine, shortleaf pine, slash pine.
						Shortleaf pine	---	

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	
WoB, WoD----------- Woodville	2c8	Slight	Moderate	Slight	Slight	Loblolly pine------- Shortleaf pine------ Sweetgum------------	86 78 ---	Loblolly pine, slash pine.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WOODLAND UNDERSTORY VEGETATION

Woodland Ordination Group Symbols *	1o7	1w6a	1w6b	1w8	1w9	2o7	2c8	2s2	2w8a	2w8b	2w9a	2w9b	3o1	3c8	3s2	3s8	3w8a	3w8b	3w9	4c2	4c3	4w6	4w9	5c3	5d3
Average Annual Production lbs/acre air dry (36-55 pct canopy)	1,100	4,000	1,400	1,500	2,000	1,200	1,600	1,200	1,600	2,000	1,200	1,800	1,300	1,800	1,200	1,200	1,000	2,000	1,700	1,800	1,200	100	1,500	1,500	1,000
Vegetation common to the soil **																									
Brackenfern	1	---	---	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	---	---	---	---	---	---	---
Bluestem, big	1	1	1	1	1	2	2	1	---	---	---	---	1	2	1	1	---	---	---	2	2	---	---	2	---
Bluestem, broomsedge	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	---	1	1	1
Bluestem, bushy	---	1	1	---	1	---	---	---	---	---	1	1	---	---	---	---	---	---	1	---	---	---	1	---	---
Bluestem, elliott	---	---	---	---	---	1	1	1	---	---	---	---	1	1	1	1	---	---	---	1	1	---	---	1	1
Bluestem, fineleaf	1	---	---	1	---	1	1	1	---	---	---	---	1	2	2	1	---	---	---	2	2	---	---	2	2
Bluestem, pinehill	5	4	4	5	5	5	5	5	5	4	3	2	5	5	5	5	4	4	4	5	5	---	4	5	5
Bluestem, slender	1	---	---	1	---	1	1	1	---	---	---	---	1	1	1	1	---	---	---	1	1	---	---	1	1
Bluestem, splitbeard	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	---	1	1	1	---	1	1	1
Carpetgrass	1	1	1	1	1	1	1	---	1	1	1	2	---	1	---	---	---	1	1	---	---	---	1	---	---
Crabgrass, shaggy	---	---	---	---	---	---	---	1	---	---	---	---	1	---	1	1	---	---	---	---	---	---	---	---	---
Dropseed, pineywood	2	---	---	---	---	2	2	2	---	---	---	---	2	2	2	2	---	---	---	2	2	---	---	2	1
Dropseed, slender	1	---	---	---	---	1	1	1	---	---	---	---	1	1	1	1	---	---	---	---	---	---	---	---	2
Gamagrass, eastern	1	1	1	1	1	1	---	---	1	1	1	1	---	---	---	---	---	1	---	---	---	---	---	---	---
Indiangrass, slender	---	---	---	---	---	---	---	1	---	---	---	---	---	---	1	1	---	---	---	---	---	---	---	---	---
Indiangrass, yellow	1	---	---	---	---	1	2	1	1	1	---	---	1	2	---	1	---	1	---	1	1	---	---	1	---
Jointtail, Carolina	1	---	---	---	---	1	1	1	---	---	---	---	---	1	---	1	---	---	---	---	---	---	---	---	---
Lovegrass, purple	1	---	---	---	---	1	1	1	---	---	---	---	1	1	1	1	---	---	---	---	---	---	---	---	1
Muhly, cutover	1	---	---	1	1	1	2	1	2	2	2	1	1	2	---	1	2	---	2	2	2	---	2	2	---
Panicum, beaked	1	1	1	2	2	1	1	---	2	2	2	2	---	1	---	---	2	---	2	---	---	---	3	---	---
Panicums, low	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	---	1	1	1
Panicum, spreading	1	2	1	2	2	1	1	---	2	3	2	1	---	1	---	---	2	---	2	---	---	---	2	---	---
Paspalum, brownseed	2	1	1	2	2	2	1	---	2	3	2	1	1	1	---	---	1	---	1	1	1	---	1	1	1
Paspalum, Florida	1	---	---	1	1	1	1	---	1	1	1	1	---	1	---	---	1	1	1	1	1	---	1	---	---
Paspalum, fringeleaf	1	---	---	---	---	1	---	1	---	---	---	2	1	1	1	1	---	2	---	1	1	---	---	1	---
Plumegrass, silver	---	---	---	---	---	---	---	---	1	1	---	2	---	---	---	---	---	---	---	---	---	---	---	---	---
Plumegrass, bentawn	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Skeletongrass, bearded	---	---	---	---	---	1	---	---	---	---	---	---	1	---	---	---	---	---	---	---	1	---	---	---	---
Switchcane	---	4	2	1	1	---	---	---	1	1	1	2	---	---	---	---	2	---	2	---	---	---	2	---	---
Switchgrass	1	1	2	1	1	1	1	---	1	1	2	1	---	1	---	---	2	1	2	1	1	---	2	1	---

See footnotes at end of table.

TABLE 8.--WOODLAND UNDERSTORY VEGETATION--Continued

Woodland Ordination Group Symbols *	1o7	1w6a	1w6b	1w8	1w9	2o7	2c8	2s2	2w8a	2w8b	2w9a	2w9b	3o1	3c8	3s2	3s8	3w8a	3w8b	3w9	4c2	4c3	4w6	4w9	5c3	5d3
Average Annual Production lbs/acre air dry (36-55 pct canopy)	1,100	4,000	1,400	1,500	2,000	1,200	1,600	1,200	1,600	2,000	1,200	1,800	1,300	1,800	1,200	1,200	1,000	2,000	1,700	1,800	1,20C	100	1,500	1,500	1,000
Vegetation common to the soil **																									
Threeawn spp.----------	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	---	1	1	1	---	1	1	1
Tridens, longspike----	---	1	1	1	1	---	1	---	1	1	1	1	---	1	---	---	1	---	1	---	---	---	1	---	---
Tridens, pinebarren---	1	---	---	1	1	1	1	---	---	---	---	---	---	1	---	---	---	---	---	1	1	---	---	1	---
Tridens, purpletop----	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	---	---	---	1	1	---	1	1	---
Uniola, longleaf------	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	---	3	2	2
Wildrye, Canada-------	1	1	1	1	1	1	1	1	1	2	1	3	1	1	---	1	1	1	1	1	1	---	1	---	---
Wildrye, Virginia-----	1	2	1	1	1	1	1	1	1	3	1	3	1	1	---	1	1	1	1	1	1	---	1	---	---
Rush spp.------------	1	1	1	1	1	1	1	---	1	1	1	1	---	1	---	---	1	1	1	---	---	2	1	---	---
Sedge spp.------------	1	2	2	1	1	1	1	1	1	1	2	2	1	1	1	1	2	1	2	1	1	3	2	---	1
Blackberry------------	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	---	1	1	1
Dewberry--------------	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	---	1	1	1	---	1	1	1
Creeper, Virginia-----	---	---	---	1	---	1	1	1	---	---	---	---	---	---	---	---	---	1	---	---	---	---	---	---	---
Grape, muscadine------	1	1	1	1	1	1	1	1	1	1	1	1	1	1	---	1	1	1	1	1	1	---	1	1	1
Grape, sandflat-------	---	---	---	---	---	---	---	1	---	---	---	---	---	---	1	---	---	---	---	---	---	---	---	---	---
Grape, other spp.-----	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1	---	---	---	---	---	---	---	---	---	---
Greenbrier------------	2	2	2	2	2	2	1	1	2	2	2	1	1	1	1	1	2	1	2	1	1	---	2	1	1
Honeysuckle-----------	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	---	1	1	---
Jessamine, Carolina---	2	---	---	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	---	1	1	---
Palmetto, dwarf-------	1	1	3	1	1	---	1	---	1	1	1	1	---	1	---	---	1	---	1	---	---	2	1	---	---
Peppervine------------	---	1	1	1	---	---	---	---	---	1	1	1	---	---	---	---	1	---	1	---	---	---	1	---	---
Poison ivy------------	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	---	1	1	1
Supplejack, Alabama---	1	---	1	1	1	1	1	1	1	1	1	---	1	1	1	1	1	---	1	1	1	1	1	1	1
Yucca-----------------	---	---	---	---	---	---	---	1	---	---	---	---	---	---	1	---	---	---	---	---	---	---	---	---	---
Bigelowia, slender----	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1
Croton----------------	1	---	---	---	---	1	1	1	---	---	---	---	1	1	1	1	---	---	---	1	1	---	---	1	1
Gayfeather------------	1	---	---	---	---	1	1	1	---	---	---	---	1	1	1	1	---	---	---	1	1	---	---	1	1
Goldaster, grassleaf--	1	---	---	---	---	1	1	1	---	---	---	---	1	1	1	1	---	---	---	1	1	---	---	1	1
Goldenrod-------------	1	---	---	---	---	1	---	1	---	---	---	---	1	1	1	1	---	---	---	1	1	---	---	1	---
Lespedeza, common-----	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1	1	---	---	1	1
Pea, partridge--------	1	---	---	1	1	1	1	1	1	1	1	1	1	1	1	1	---	---	---	1	1	---	---	1	---
Poke------------------	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	---	1	1	1	---	1	1	---

See footnotes at end of table.

TABLE 8.--WOODLAND UNDERSTORY VEGETATION--Continued

Woodland Ordination Group Symbols *	1o7	1w6a	1w6b	1w8	1w9	2o7	2c8	2s2	2w8a	2w8b	2w9a	2w9b	3o1	3c8	3s2	3s8	3w8a	3w8b	3w9	4c2	4c3	4w6	4w9	5c3	5d3
Average Annual Production lbs/acre air dry (36-55 pct canopy)	1,100	4,000	1,400	1,500	2,000	1,200	1,600	1,200	1,600	2,000	1,200	1,800	1,300	1,800	1,200	1,200	1,000	2,000	1,700	1,800	1,200	100	1,500	1,500	1,000
Vegetation common to the soil **																									
Ragweed, western	1	1	1	1	1	1	1	1	1	1	1	1	1	1	---	1	---	1	---	1	1	---	---	1	1
St. Andrews cross	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	---	1	1	1	1	1	1	1
Smartweed	---	1	1	1	1	---	---	---	1	1	1	1	---	---	---	---	1	---	1	---	---	1	1	---	---
Snakeroot, white	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	---	1	---	---	1	1	---	---
Sumpweed	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Sunflower, swamp	1	1	1	1	1	1	1	1	1	1	1	1	1	1	---	1	---	1	---	1	---	---	---	---	---
Tephrosia, Virginia	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1	---	---	---	---	---	---	---	---	---	---
Tickclover	1	---	---	---	---	1	1	1	---	---	---	---	1	1	2	1	---	---	---	1	1	---	---	1	---
Bacchris	---	1	1	1	---	---	---	---	1	---	---	---	---	---	---	---	1	1	1	---	---	---	---	---	---
Bayberry, southern	---	---	---	---	---	---	---	---	1	1	1	1	---	---	---	---	---	1	---	---	---	---	1	---	---
Beautyberry, American	1	---	---	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	---	1	1	1
Blackgum	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	---	1	1	1	1	1	1	1
Buttonbush	---	---	1	---	---	---	---	---	---	---	---	1	---	---	---	---	---	---	---	---	---	1	---	---	---
Coralberry	1	1	1	1	1	---	1	1	1	1	1	1	1	1	1	1	---	---	---	---	---	---	---	---	---
Cyrilla, swamp	---	1	1	1	1	---	---	---	1	1	1	1	---	---	---	---	1	---	1	---	---	---	1	---	---
Dogwood, flowering	1	---	---	1	1	1	1	1	---	---	---	---	1	1	2	1	---	---	---	1	---	---	---	---	---
Hawthorn	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	---	1	1	1	---	1	1	1
Holly, American	1	1	1	1	1	1	1	---	1	1	1	1	1	1	---	---	2	1	2	---	---	---	2	---	---
Huckleberry	1	1	1	1	1	1	1	1	1	---	1	1	1	1	1	1	1	1	1	1	1	---	1	---	---
Maple, red	1	1	1	1	1	1	1	---	1	1	1	---	---	1	---	---	1	---	1	1	---	1	1	---	---
Oak, bluejack	---	---	---	---	---	---	---	1	---	---	---	---	---	---	1	1	---	---	---	---	---	---	---	---	---
Osageorange	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1	---	1	---	---	---	1	---
Persimmon, common	---	---	---	---	---	---	---	1	---	---	---	---	---	---	1	---	---	---	---	---	1	---	---	---	---
Sassafras	1	---	---	---	---	1	1	1	1	1	---	---	1	1	1	1	---	---	---	---	---	---	---	---	---
Sumac	1	1	1	1	1	1	1	1	1	1	1	---	1	1	1	1	1	---	---	1	1	---	---	1	---
Waxmyrtle	1	2	2	2	2	1	---	---	2	2	2	---	1	---	---	---	2	---	2	---	---	2	2	---	---
Yaupon	1	1	1	2	2	2	1	2	2	2	2	---	2	1	2	2	1	1	1	1	1	---	1	1	1

* The woodland ordination group symbol for each soil is shown at the end of each map unit description and in Table 7.--Woodland Management and Productivity.

** 1 indicates that the named plant occurs on the soil in an amount less than 5 percent.
2 indicates that the named plant occurs on the soil in an amount of 5 to 10 percent.
3 indicates that the named plant occurs on the soil in an amount of 10 to 25 percent.
4 indicates that the named plant occurs on the soil in an amount of 25 to 50 percent.
5 indicates that the named plant occurs on the soil in an amount more than 50 percent.
Absence of an entry indicates that the named plant does not occur on the soil.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
BeB: Bernaldo	Slight	Slight	Slight	Slight	Slight.
BeC: Bernaldo	Slight	Slight	Moderate: slope.	Slight	Slight.
BfB: Betis	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Moderate: droughty, too sandy.
BnB: Bienville	Slight	Slight	Slight	Slight	Moderate: droughty.
BoB: Boykin	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Slight.
BuD: Burkeville	Severe: percs slowly, too clayey, wetness.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness, percs slowly.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
CaB: Choates	Moderate: wetness, too sandy, percs slowly.	Moderate: wetness, too sandy, percs slowly.	Moderate: slope, wetness, too sandy.	Moderate: wetness.	Moderate: wetness, droughty.
CfB: Colita	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
ClB:					
Colita	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Laska	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Moderate: wetness.	Moderate: wetness, droughty.
CpC:					
Colita	Severe: wetness, depth to rock.	Severe: depth to rock.	Severe: wetness, depth to rock.	Severe: erodes easily.	Severe: thin layer.
Kitterll	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Severe: thin layer.
CrB: Conroe	Severe: small stones.	Severe: small stones.	Severe: small stones.	Moderate: too sandy.	Severe: small stones.
CrC: Conroe	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Moderate: too sandy.	Severe: small stones.
DaA: Dallardsville	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness, droughty.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
DbB----------------- Diboll	Severe: wetness, percs slowly, excess sodium.	Severe: wetness, excess sodium, percs slowly.	Severe: wetness, percs slowly, excess sodium.	Severe: wetness.	Severe: wetness, excess sodium.
DkB:					
Diboll--------------	Severe: wetness, percs slowly, excess sodium.	Severe: wetness, excess sodium, percs slowly.	Severe: wetness, percs slowly, excess sodium.	Severe: wetness.	Severe: wetness, excess sodium.
Keltys--------------	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
DoB----------------- Doucette	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
Fa------------------ Fausse	Severe: flooding, ponding, percs slowly.	Severe: ponding, too clayey, excess humus.	Severe: too clayey, excess humus, ponding.	Severe: ponding, too clayey, excess humus.	Severe: ponding, flooding, too clayey.
GaA, GaB------------ Garner	Severe: percs slowly, too clayey, wetness.	Severe: too clayey, percs slowly, wetness.	Severe: too clayey, wetness.	Severe: too clayey.	Severe: too clayey.
Ha------------------ Hatliff	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Hf------------------ Hatliff	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
HrB, HrC------------ Herty	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
Ka------------------ Kaman	Severe: flooding, wetness, percs slowly.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
Kf------------------ Kaman	Severe: flooding, wetness, percs slowly.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness, flooding.	Severe: wetness, too clayey.	Severe: wetness, flooding, too clayey.
KlB----------------- Keltys	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
KM:					
Kian----------------	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
Mantachie-----------	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
KvA: Kirbyville	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
LaB: Laska	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Moderate: wetness.	Moderate: wetness, droughty.
LgB: Leggett	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
MoB: Moswell	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
MoD: Moswell	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Slight	Moderate: slope.
Na: Nahatche	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
OaB: Oakhurst	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
OaC: Oakhurst	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: slope, wetness, percs slowly.	Severe: wetness.	Severe: wetness.
OtA: Otanya	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Slight	Slight.
Oz:					
Ozias	Severe: flooding, wetness, percs slowly.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness, flooding.	Severe: too clayey.	Severe: flooding, too clayey.
Pophers	Severe: flooding, wetness.	Severe: wetness, too acid.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
PaB, PfB: Pinetucky	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
PGB:					
Pinetucky	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: small stones, percs slowly.	Slight	Slight.
Conroe	Severe: small stones.	Severe: small stones.	Severe: small stones.	Slight	Severe: small stones.
PK:					
Pluck	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
Kian	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Pp------------------- Pophers	Severe: flooding, wetness.	Severe: wetness, too acid.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
RaB------------------ Rayburn	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Severe: erodes easily.	Slight.
RaD------------------ Rayburn	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope.
SoA------------------ Sorter	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
SpA------------------ Splendora	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, erodes easily.	Severe: wetness.
SrB------------------ Spurger	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly, slope.	Slight----------	Slight.
SrD------------------ Spurger	Moderate: percs slowly, slope.	Moderate: percs slowly, slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
STE:					
Stringtown-----------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
Bonwier-------------	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight----------	Moderate: slope.
Vr------------------- Voss	Severe: flooding, too sandy.	Severe: too sandy.	Severe: too sandy, flooding.	Severe: too sandy.	Severe: droughty.
Vs------------------- Voss	Severe: flooding, too sandy.	Severe: too sandy.	Severe: too sandy, flooding.	Severe: too sandy.	Severe: droughty, flooding.
WaA------------------ Waller	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
WgB------------------ Wiergate	Severe: percs slowly, too clayey, wetness.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
WgC------------------ Wiergate	Severe: percs slowly, too clayey, wetness.	Severe: wetness, too clayey, percs slowly.	Severe: slope, too clayey, wetness.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
WoB------------------ Woodville	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Severe: erodes easily.	Slight.
WoD------------------ Woodville	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope.

TABLE 10.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
BeB----------------Bernaldo	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BeC----------------Bernaldo	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BfB----------------Betis	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
BnB----------------Bienville	Fair	Fair	Fair	Good	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
BoB----------------Boykin	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
BuD----------------Burkeville	Fair	Fair	Fair	Fair	Poor	Poor	Very poor.	Fair	Fair	Very poor.
CaB----------------Choates	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
CfB----------------Colita	Poor	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Poor
ClB:										
Colita------------	Poor	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Poor
Laska-------------	Fair	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor
CpC:										
Colita------------	Poor	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Poor
Kitterll----------	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.
CrB, CrC-----------Conroe	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Good	Very poor.
DaA----------------Dallardsville	Fair	Good	Good	Good	Good	Fair	Fair	Fair	Good	Fair
DbB----------------Diboll	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair
DkB:										
Diboll------------	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Keltys------------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
DoB----------------Doucette	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Fa-----------------Fausse	Very poor.	Very poor.	Very poor.	Poor	Poor	Good	Good	Very poor.	Poor	Good

TABLE 10.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
GaA: Garner	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Fair	Poor
GaB: Garner	Fair	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
Ha, Hf: Hatliff	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor
HrB, HrC: Herty	Fair	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor
Ka: Kaman	Fair	Fair	Fair	Good	Poor	Fair	Good	Fair	Good	Fair
Kf: Kaman	Poor	Fair	Poor	Fair	Poor	Poor	Good	Poor	Fair	Fair
KlB: Keltys	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
KM:										
Kian	Poor	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair
Mantachie	Poor	Fair	Fair	Good	---	Fair	Fair	Fair	Good	Fair
KvA: Kirbyville	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair
LaB: Laska	Fair	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor
LgB: Leggett	Poor	Fair	Fair	Fair	Fair	Good	Fair	Poor	Fair	Fair
MoB: Moswell	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MoD: Moswell	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Fair	Very poor.
Na: Nahatche	Fair	Fair	Fair	Good	Fair	Poor	Fair	Fair	Good	Poor
OaB, OaC: Oakhurst	Fair	Good	Fair	Good	Good	Fair	Very poor.	Fair	Good	Poor
OtA: Otanya	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor
Oz:										
Ozias	Poor	Fair	Fair	Fair	Very poor.	Fair	Good	Fair	Fair	Good
Pophers	Fair	Fair	Fair	Good	Poor	Fair	Fair	Fair	Good	Fair
PaB, PfB: Pinetucky	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

TABLE 10.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
PGB:										
Pinetucky	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Conroe	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Good	Very poor.
PK:										
Pluck	Poor	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair
Kian	Poor	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair
Pp Pophers	Fair	Fair	Fair	Good	Poor	Fair	Fair	Fair	Good	Fair
RaB, RaD Rayburn	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
SoA Sorter	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good
SpA Splendora	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor
SrB, SrD Spurger	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor
STE:										
Stringtown	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Bonwier	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Vr, Vs Voss	Poor	Poor	Fair	Good	Good	Poor	Poor	Poor	Good	Poor
WaA Waller	Poor	Fair	Fair	Good	Fair	Good	Good	Fair	Good	Good
WgB, WgC Wiergate	Fair	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
WoB, WoD Woodville	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
BeB Bernaldo	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
BeC Bernaldo	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
BfB Betis	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
BnB Bienville	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight	Moderate: droughty.
BoB Boykin	Slight	Slight	Slight	Slight	Moderate: low strength.	Slight.
BuD Burkeville	Severe: wetness, cutbanks cave.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, too clayey.
CaB Choates	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
CfB Colita	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
ClB:						
Colita	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Laska	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
CpC:						
Colita	Severe: depth to rock, wetness.	Severe: wetness.	Severe: wetness, depth to rock.	Severe: wetness.	Moderate: depth to rock, wetness, shrink-swell.	Severe: thin layer.
Kitterll	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Severe: thin layer.
CrB Conroe	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Severe: small stones.
CrC Conroe	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: wetness.	Severe: small stones.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
DaA: Dallardsville	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
DbB: Diboll	Poor: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, excess sodium.
DkB:						
Diboll	Poor: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, excess sodium.
Keltys	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Slight	Slight.
DoB: Doucette	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: low strength.	Slight.
Fa: Fausse	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: low strength, ponding, flooding.	Severe: ponding, flooding, too clayey.
GaA, GaB: Garner	Severe: cutbanks cave, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell, wetness.	Severe: too clayey.
Ha: Hatliff	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.
Hf: Hatliff	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.
HrB, HrC: Herty	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
Ka: Kaman	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness.	Severe: wetness, too clayey.
Kf: Kaman	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding, too clayey.
KlB: Keltys	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Slight	Slight.
KM:						
Kian	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.
Mantachie	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
KvA------------- Kirbyville	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: low strength.	Moderate: wetness.
LaB------------- Laska	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
LgB------------- Leggett	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness.	Severe: wetness.
MoB------------- Moswell	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
MoD------------- Moswell	Moderate: too clayey, wetness, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
Na-------------- Nahatche	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness.	Severe: wetness.
OaB, OaC---------- Oakhurst	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, low strength, shrink-swell.	Severe: wetness.
OtA------------- Otanya	Moderate: wetness.	Slight---------	Moderate: wetness.	Slight---------	Slight---------	Slight.
Oz:						
Ozias-----------	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, flooding.	Severe: flooding, too clayey.
Pophers----------	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding.	Severe: flooding.
PaB, PfB---------- Pinetucky	Slight---------	Slight---------	Slight---------	Slight---------	Severe: low strength.	Slight.
PGB:						
Pinetucky--------	Slight---------	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
Conroe-----------	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: low strength.	Severe: small stones.
PK:						
Pluck------------	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.
Kian-------------	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.
Pp--------------- Pophers	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding.	Severe: flooding.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
RaB--------------- Rayburn	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
RaD--------------- Rayburn	Moderate: too clayey, wetness, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
SoA--------------- Sorter	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
SpA--------------- Splendora	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
SrB--------------- Spurger	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
SrD--------------- Spurger	Moderate: too clayey, wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, shrink-swell, slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
STE:						
Stringtown--------	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
Bonwier-----------	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
Vr---------------- Voss	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding.	Severe: droughty.
Vs---------------- Voss	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: droughty, flooding.
WaA--------------- Waller	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
WgB, WgC---------- Wiergate	Severe: wetness, cutbanks cave.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, too clayey.
WoB--------------- Woodville	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
WoD--------------- Woodville	Moderate: too clayey, wetness, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
BeB, BeC: Bernaldo	Moderate: wetness.	Moderate: seepage.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
BfB: Betis	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
BnB: Bienville	Moderate: wetness.	Severe: seepage.	Severe: seepage, wetness.	Severe: seepage.	Fair: too sandy.
BoB: Boykin	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
BuD: Burkeville	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness.
CaB: Choates	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Fair: wetness.
CfB: Colita	Severe: depth to rock, wetness.	Severe: seepage, depth to rock.	Severe: depth to rock, wetness.	Severe: seepage, wetness.	Poor: wetness.
ClB:					
Colita	Severe: depth to rock, wetness.	Severe: seepage, depth to rock.	Severe: depth to rock, wetness.	Severe: seepage, wetness.	Poor: wetness.
Laska	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Fair: too sandy, wetness.
CpC:					
Colita	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Severe: depth to rock, seepage, wetness.	Poor: area reclaim, wetness.
Kitterll	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
CrB, CrC: Conroe	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Moderate: wetness, too clayey.	Severe: seepage.	Fair: too clayey, hard to pack.
DaA: Dallardsville	Severe: wetness, percs slowly.	Severe: wetness, seepage.	Severe: wetness.	Severe: wetness, seepage.	Poor: wetness.
DbB: Diboll	Severe: wetness, percs slowly.	Severe: wetness.	Severe: depth to rock, wetness, excess sodium.	Severe: wetness.	Poor: wetness, excess sodium.

TABLE 12.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
DkB:					
Diboll	Severe: wetness, percs slowly.	Severe: wetness.	Severe: depth to rock, wetness, excess sodium.	Severe: wetness.	Poor: wetness, excess sodium.
Keltys	Severe: wetness, percs slowly.	Severe: wetness.	Severe: depth to rock.	Moderate: wetness, depth to rock.	Fair: area reclaim, wetness.
DoB Doucette	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Fa Fausse	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding, too clayey.	Severe: flooding, ponding.	Poor: too clayey, hard to pack, ponding.
GaA Garner	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Moderate: wetness.	Poor: too clayey, hard to pack.
GaB Garner	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey, wetness.	Moderate: wetness.	Poor: too clayey, hard to pack.
Ha Hatliff	Severe: wetness.	Severe: seepage, flooding, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Hf Hatliff	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
HrB, HrC Herty	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Poor: too clayey, hard to pack, wetness.
Ka Kaman	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Kf Kaman	Severe: flooding, wetness, percs slowly.	Slight	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
KlB Keltys	Severe: wetness, percs slowly.	Severe: wetness.	Severe: depth to rock.	Moderate: wetness, depth to rock.	Fair: area reclaim, wetness.
KM:					
Kian	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, seepage, wetness.	Poor: wetness.

TABLE 12.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
KM:					
Mantachie	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
KvA Kirbyville	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Fair: wetness.
LaB Laska	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Fair: too sandy, wetness.
LgB Leggett	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
MoB Moswell	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness, too clayey, too acid.	Moderate: wetness.	Poor: too clayey, hard to pack, too acid.
MoD Moswell	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness, too clayey, too acid.	Moderate: slope, wetness.	Poor: too clayey, hard to pack, too acid.
Na Nahatche	Severe: wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
OaB, OaC Oakhurst	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, wetness, hard to pack.
OtA Otanya	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Slight	Fair: too clayey, wetness.
Oz:					
Ozias	Severe: flooding, percs slowly, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Severe: too clayey, wetness, hard to pack.
Pophers	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
PaB, PfB Pinetucky	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
PGB:					
Pinetucky	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
Conroe	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, hard to pack.

TABLE 12.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
PK:					
Pluck----------------	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: flooding, wetness.	Poor: wetness.
Kian-----------------	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, seepage, wetness.	Poor: wetness.
Pp------------------- Pophers	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
RaB------------------ Rayburn	Severe: wetness, percs slowly.	Severe: wetness.	Severe: depth to rock, too clayey.	Moderate: wetness, depth to rock.	Poor: too clayey, hard to pack.
RaD------------------ Rayburn	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: depth to rock, too clayey.	Moderate: depth to rock, wetness, slope.	Poor: too clayey, hard to pack.
SoA------------------ Sorter	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
SpA------------------ Splendora	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
SrB------------------ Spurger	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
SrD------------------ Spurger	Severe: percs slowly, wetness.	Severe: wetness, slope.	Severe: too clayey.	Moderate: wetness, slope.	Poor: too clayey, hard to pack.
STE:					
Stringtown-----------	Moderate: slope.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope, small stones.
Bonwier--------------	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
Vr------------------- Voss	Severe: wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Vs------------------- Voss	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy.
WaA------------------ Waller	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.

TABLE 12.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
WgB, WgC------------ Wiergate	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
WoB----------------- Woodville	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, hard to pack.
WoD----------------- Woodville	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, hard to pack.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
BeB, BeC: Bernaldo	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
BfB: Betis	Good	Improbable: thin layer.	Improbable: too sandy.	Fair: too sandy.
BnB: Bienville	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
BoB: Boykin	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
BuD: Burkeville	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
CaB: Choates	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
CfB: Colita	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
ClB:				
Colita	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Laska	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
CpC:				
Colita	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Kitterll	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
CrB, CrC: Conroe	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
DaA: Dallardsville	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
DbB: Diboll	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess sodium.
DkB:				
Diboll	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess sodium.
Keltys	Fair: low strength, area reclaim, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
DoB: Doucette	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Fa: Fausse	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
GaA, GaB: Garner	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Ha, Hf: Hatliff	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness, thin layer.
HrB, HrC: Herty	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness, too clayey.
Ka, Kf: Kaman	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
KlB: Keltys	Fair: low strength, area reclaim, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
KM:				
Kian	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Mantachie	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
KvA: Kirbyville	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
LaB: Laska	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
LgB: Leggett	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
MoB, MoD: Moswell	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, too acid.
Na: Nahatche	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
OaB, OaC: Oakhurst	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
OtA: Otanya	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
Oz:				
Ozias	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Pophers	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
PaB, PfB: Pinetucky	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
PGB:				
Pinetucky	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Conroe	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
PK:				
Pluck	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Kian	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Pp: Pophers	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
RaB, RaD: Rayburn	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
SoA: Sorter	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
SpA: Splendora	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
SrB, SrD: Spurger	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
STE:				
Stringtown	Fair: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
Bonwier	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Vr, Vs: Voss	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
WaA: Waller	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
WgB, WgC: Wiergate	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
WoB, WoD-------------- Woodville	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Map symbol and soil name	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Drainage	Features affecting-- Grassed waterways
BeB: Bernaldo	Moderate: seepage.	Moderate: piping.	Moderate: deep to water, slow refill.	Deep to water	Favorable.
BeC: Bernaldo	Moderate: seepage.	Moderate: piping.	Moderate: deep to water, slow refill.	Deep to water	Favorable.
BfB: Betis	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty.
BnB: Bienville	Severe: seepage.	Severe: piping.	Severe: cutbanks cave.	Deep to water	Droughty.
BoB: Boykin	Moderate: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Favorable.
BuD: Burkeville	Slight	Moderate: hard to pack.	Severe: no water.	Percs slowly	Percs slowly, wetness.
CaB: Choates	Severe: seepage.	Severe: piping, wetness.	Severe: slow refill, cutbanks cave.	Slope	Droughty.
CfB: Colita	Severe: seepage.	Severe: piping.	Severe: no water.	Favorable	Erodes easily.
ClB:					
Colita	Severe: seepage.	Severe: piping.	Severe: no water.	Slope	Erodes easily.
Laska	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Slope, cutbanks cave.	Favorable.
CpC:					
Colita	Severe: depth to rock.	Severe: piping.	Severe: no water.	Depth to rock, slope.	Wetness, erodes easily, depth to rock.
Kitterll	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock.
CrB, CrC: Conroe	Slight	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Droughty, rooting depth.
DaA: Dallardsville	Severe: seepage.	Severe: piping.	Severe: no water.	Cutbanks cave	Wetness, erodes easily.

TABLE 14.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Grassed waterways
DbB: Diboll	Moderate: depth to rock.	Severe: piping, wetness, excess sodium.	Severe: no water.	Percs slowly, excess sodium.	Wetness, excess sodium, erodes easily.
DkB:					
Diboll	Moderate: depth to rock.	Severe: piping, wetness, excess sodium.	Severe: no water.	Percs slowly, slope, excess sodium.	Wetness, excess sodium, erodes easily.
Keltys	Moderate: depth to rock.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Percs slowly, erodes easily.
DoB: Doucette	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Favorable.
Fa: Fausse	Slight	Severe: hard to pack, ponding.	Severe: slow refill.	Ponding, percs slowly, flooding.	Wetness, percs slowly.
GaA: Garner	Slight	Severe: hard to pack.	Severe: no water.	Deep to water	Percs slowly.
GaB: Garner	Slight	Severe: hard to pack.	Severe: no water.	Deep to water	Percs slowly.
Ha: Hatliff	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.
Hf: Hatliff	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty.
HrB: Herty	Slight	Severe: hard to pack, wetness.	Severe: no water.	Percs slowly	Wetness, erodes easily.
HrC: Herty	Slight	Severe: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Wetness, erodes easily.
Ka: Kaman	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly	Wetness, percs slowly.
Kf: Kaman	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, flooding.	Wetness, percs slowly.
KlB: Keltys	Moderate: depth to rock.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Percs slowly, erodes easily.

TABLE 14.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Drainage	Features affecting-- Grassed waterways
KM:					
Kian	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave, flooding.	Wetness.
Mantachie	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Flooding	Wetness.
KvA Kirbyville	Moderate: seepage.	Severe: wetness.	Moderate: deep to water, slow refill.	Favorable	Good.
LaB Laska	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Slope, cutbanks cave.	Favorable.
LgB Leggett	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Favorable	Wetness.
MoB Moswell	Slight	Severe: hard to pack.	Severe: slow refill.	Deep to water	Erodes easily, percs slowly.
MoD Moswell	Slight	Severe: hard to pack.	Severe: slow refill.	Deep to water	Slope, erodes easily, percs slowly.
Na Nahatche	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Favorable	Wetness.
OaB, OaC Oakhurst	Slight	Severe: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Wetness, erodes easily, percs slowly.
OtA Otanya	Moderate: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Favorable.
Oz:					
Ozias	Slight	Severe: wetness, hard to pack.	Severe: slow refill.	Percs slowly, flooding, excess salt.	Excess salt, percs slowly, wetness.
Pophers	Slight	Severe: wetness.	Severe: slow refill.	Percs slowly, flooding, too acid.	Erodes easily, percs slowly.
PaB Pinetucky	Slight	Moderate: piping.	Severe: no water.	Deep to water	Favorable.
PfB Pinetucky	Slight	Moderate: piping.	Severe: no water.	Deep to water	Favorable.
PGB:					
Pinetucky	Slight	Moderate: piping.	Severe: no water.	Deep to water	Rooting depth.
Conroe	Slight	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly	Rooting depth.

TABLE 14.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Grassed waterways
PK:					
Pluck	Severe: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Flooding	Wetness.
Kian	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave, flooding.	Wetness.
Pp Pophers	Slight	Severe: wetness.	Severe: slow refill.	Percs slowly, flooding, too acid.	Erodes easily, percs slowly.
RaB Rayburn	Moderate: depth to rock.	Severe: hard to pack.	Severe: no water.	Percs slowly, slope.	Erodes easily, percs slowly.
RaD Rayburn	Moderate: depth to rock.	Severe: hard to pack.	Severe: no water.	Percs slowly, slope.	Slope, erodes easily, percs slowly.
SoA Sorter	Slight	Severe: piping, ponding.	Severe: no water.	Ponding, percs slowly.	Wetness, erodes easily, rooting depth.
SpA Splendora	Slight	Severe: wetness.	Severe: no water.	Percs slowly	Wetness, erodes easily, rooting depth.
SrB, SrD Spurger	Slight	Moderate: hard to pack.	Severe: no water.	Percs slowly, slope.	Percs slowly, erodes easily.
STE:					
Stringtown	Severe: slope.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Slope.
Bonwier	Slight	Severe: hard to pack.	Severe: no water.	Deep to water	Slope.
Vr Voss	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Droughty.
Vs Voss	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Droughty.
WaA Waller	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Percs slowly	Wetness, erodes easily, percs slowly.
WgB, WgC Wiergate	Slight	Severe: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Percs slowly, wetness.
WoB Woodville	Slight	Severe: hard to pack.	Severe: slow refill.	Percs slowly, slope.	Erodes easily, percs slowly.

TABLE 14.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Grassed waterways
WoD---------------- Woodville	Slight---------	Severe: hard to pack.	Severe: slow refill.	Percs slowly, slope.	Slope, erodes easily, percs slowly.

TABLE 15.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
BeB--------------- Bernaldo	0-19	Fine sandy loam, loamy very fine sand.	SM, ML, CL-ML, SM-SC	A-4	0	100	95-100	90-100	40-75	<25	NP-5
	19-41	Loam, sandy clay loam, clay loam.	CL	A-6	0	100	100	90-100	51-75	26-40	12-24
	41-71	Fine sandy loam, loam.	CL, SC, ML SM	A-4, A-6, A-2	0	100	95-100	90-100	28-65	20-40	3-22
	71-80	Variable---------	---	---	---	---	---	---	---	---	---
BeC--------------- Bernaldo	0-15	Fine sandy loam, loamy very fine sand.	SM, ML, CL-ML, SM-SC	A-4	0	100	95-100	90-100	40-75	<25	NP-5
	15-33	Loam, sandy clay loam, clay loam.	CL	A-6	0	100	100	90-100	51-75	26-40	12-24
	33-60	Fine sandy loam, loam.	CL, SC, ML SM	A-4, A-6, A-2	0	100	95-100	90-100	28-65	20-40	3-22
	60-65	Variable---------	---	---	---	---	---	---	---	---	---
BfB--------------- Betis	0-24	Loamy fine sand	SM, SP-SM	A-2	0	100	97-100	90-100	10-35	---	NP
	24-80	Loamy fine sand, fine sandy loam, fine sand.	SM	A-2, A-4	0	100	97-100	90-100	25-50	---	NP
BnB--------------- Bienville	0-24	Loamy fine sand	SM	A-2-4, A-4	0	100	100	90-100	25-50	<25	NP-3
	24-80	Loamy fine sand, fine sandy loam, fine sand.	SM, ML	A-2-4, A-4	0	100	100	90-100	30-55	<25	NP-3
BoB--------------- Boykin	0-22	Loamy fine sand	SM	A-2-4, A-4	0	97-100	95-100	70-98	17-45	<25	NP-4
	22-70	Fine sandy loam, sandy clay loam.	SC, CL	A-4, A-6, A-7-6	0	95-100	95-100	80-98	36-55	22-45	8-30
BuD--------------- Burkeville	0-60	Clay-------------	CH	A-7-6	0	98-100	98-100	90-100	80-98	55-80	35-55
CaB--------------- Choates	0-24	Loamy fine sand	SM	A-2-4, A-4	0	97-100	95-100	75-100	15-40	<28	NP-4
	24-80	Sandy clay loam, fine sandy loam, sandy loam.	SC, CL, SM-SC, CL-ML	A-6, A-4, A-7, A-2	0	95-100	90-100	75-100	34-55	20-43	4-22
CfB--------------- Colita	0-11	Fine sandy loam, loamy very fine sand.	SM, ML, SM-SC, CL-ML	A-4	0	100	100	70-100	40-60	<25	NP-7
	11-32	Fine sandy loam, loamy very fine sand, very fine sandy loam.	SM, ML, SM-SC, CL-ML	A-4	0	100	100	70-95	40-65	<25	NP-7
	32-40	Fine sandy loam, sandy clay loam.	SM, ML, SC CL	A-4, A-6	0	100	100	70-90	36-55	<30	NP-14
	40-45	Sandy clay loam, clay loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	80-100	51-95	20-40	6-20
	45-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
ClB:											
Colita	0-16	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0	100	100	70-100	40-60	<25	NP-7
	16-32	Fine sandy loam, loamy very fine sand, very fine sandy loam.	SM, ML, SM-SC, CL-ML	A-4	0	100	100	70-95	40-65	<25	NP-7
	32-50	Sandy clay loam, clay loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	80-100	51-95	20-40	6-20
	50-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Laska	0-33	Fine sandy loam	SM, ML	A-4	0	98-100	98-100	80-100	40-60	<25	NP-3
	33-63	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4	0	98-100	98-100	80-100	40-60	<25	NP-7
CpC:											
Colita	0-7	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0	100	100	70-100	40-65	<25	NP-7
	7-11	Fine sandy loam, loamy fine sand.	SM, ML, SM-SC, CL-ML	A-4	0	100	100	70-100	40-60	<25	NP-7
	11-18	Loam, sandy clay loam.	SM, ML, SC CL	A-4, A-6	0	100	100	70-90	35-55	12-30	2-14
	18-22	Weathered bedrock	---	---	---	---	---	---	---	---	---
Kitterll	0-10	Fine sandy loam, loam, stony loam, stony fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4	0-15	90-100	90-100	60-90	36-65	<25	NP-7
	10-14	Weathered bedrock	---	---	---	---	---	---	---	---	---
CrB, CrC Conroe	0-22	Gravelly loamy fine sand.	GM, SM-SC, SM, GP-GM	A-1, A-4, A-2-4	0	35-85	35-80	20-70	10-40	<30	NP-7
	22-26	Sandy clay loam, sandy clay, clay loam.	SC, CL	A-2-6, A-2-7, A-6, A-7	0	65-95	60-95	50-90	25-60	30-47	15-31
	26-60	Sandy clay, clay	CL, SC, CH	A-7-6, A-2-7	0	80-100	75-100	60-95	32-60	40-55	20-35
DaA Dallardsville	0-5	Loamy very fine sand.	SM, ML, SM-SC, CL-ML	A-4	0	100	98-100	70-95	40-65	<20	NP-7
	5-19	Loamy very fine sand.	SM, ML	A-4	0	100	98-100	70-95	40-65	<20	NP-3
	19-33	Very fine sandy loam, loamy very fine sand.	SM, ML, SM-SC, CL-ML	A-4	0	100	98-100	70-95	40-65	<20	NP-7
	33-45	Sandy clay loam, loam.	SM-SC, SC, CL-ML, CL	A-4, A-6	0	100	98-100	80-96	36-75	20-35	5-17
	45-70	Clay loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6, A-7	0	100	98-100	85-98	45-80	20-42	5-22

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
DbB-------------- Diboll	0-22	Silt loam, very fine sandy loam, loam.	ML, CL-ML, CL	A-4	0	98-100	98-100	90-100	70-90	20-30	3-9
	22-39	Loam, silt loam, silty clay loam, clay loam.	CL	A-4, A-6	0	98-100	98-100	90-100	70-90	25-40	9-20
	39-45	Clay loam, silty clay loam, loam.	CL, CH	A-6, A-7	0	98-100	98-100	90-100	70-85	35-55	11-35
	45-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
DkB:											
Diboll----------	0-20	Very fine sandy loam.	ML, CL-ML, CL	A-4	0	98-100	98-100	90-100	70-90	20-30	3-9
	20-36	Loam, silty clay loam, clay loam.	CL	A-4, A-6	0	98-100	98-100	90-100	70-90	25-40	9-20
	36-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Keltys----------	0-29	Very fine sandy loam.	SM, SM-SC, ML, CL-ML	A-4	0	98-100	98-100	85-100	36-60	<30	NP-7
	29-55	Fine sandy loam, sandy clay loam.	SC, SM-SC, CL, CL-ML	A-4	0	98-100	98-100	85-100	36-55	20-30	4-10
	55-65	Weathered bedrock	---	---	---	---	---	---	---	---	---
DoB-------------- Doucette	0-22	Loamy fine sand	SM	A-2-4, A-4	0	97-100	95-100	80-98	15-40	<25	NP-4
	22-70	Sandy clay loam	SC, SM-SC, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-98	36-55	25-39	6-18
Fa--------------- Fausse	0-1	Muck, mucky peat	PT	A-8	0	---	---	---	---	---	---
	1-42	Clay-------------	CH	A-7-6	0	100	100	100	95-100	60-100	31-71
	42-60	Clay, silty clay, silty clay loam.	CH, MH, CL ML	A-7-6	0	100	100	100	95-100	45-100	16-71
GaA-------------- Garner	0-5	Clay-------------	CL, CH	A-6, A-7-6	0	90-100	90-100	67-100	65-100	34-58	18-37
	5-65	Clay-------------	CH	A-7-6	0	90-100	90-100	85-100	80-100	51-75	31-51
GaB-------------- Garner	0-3	Clay-------------	CL, CH	A-6, A-7-6	0	90-100	90-100	67-100	65-100	34-58	18-37
	3-65	Clay-------------	CH	A-7-6	0	90-100	90-100	85-100	80-100	51-75	31-51
Ha--------------- Hatliff	0-6	Loam-------------	CL-ML, CL	A-4	0	100	95-100	85-95	55-75	20-30	4-10
	6-70	Stratified fine sandy loam to sand.	SP-SM, SM, SC, SM-SC	A-2-4, A-4, A-3	0	100	95-100	50-90	5-45	<30	NP-9
Hf--------------- Hatliff	0-11	Loam-------------	CL-ML, CL	A-4	0	100	95-100	85-95	55-75	20-30	4-10
	11-80	Stratified fine sandy loam to sand.	SP-SM, SM, SC, SM-SC	A-2-4, A-4, A-3	0	100	95-100	50-90	5-45	<30	NP-9
HrB-------------- Herty	0-2	Silt loam--------	CL, CL-ML	A-4, A-6	0	98-100	98-100	95-100	51-85	18-30	4-12
	2-39	Clay, silty clay, silty clay loam.	CL	A-6, A-7-6	0	98-100	98-100	95-100	75-95	25-45	11-20
	39-46	Clay, silty clay	CH, CL	A-7-6	0	98-100	98-100	95-100	75-95	36-53	20-35
	46-60	Clayey shale	CH	A-7-6	0	98-100	98-100	95-100	65-95	51-75	30-50
HrC-------------- Herty	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0	98-100	98-100	95-100	51-85	18-30	4-12
	7-36	Clay, silty clay, silty clay loam.	CL	A-6, A-7-6	0	98-100	98-100	95-100	75-95	25-45	11-20
	36-48	Clay, silty clay	CH, CL	A-7-6	0	98-100	98-100	95-100	75-95	36-53	20-35
	48-60	Clayey shale	CH	A-7-6	0	98-100	98-100	95-100	65-95	51-75	30-50

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ka, Kf----------- Kaman	0-72	Clay, silty clay	CH, CL	A-7-6	0	98-100	98-100	90-100	75-90	46-66	24-42
KlB-------------- Keltys	0-29	Very fine sandy loam.	SM, SM-SC, ML, CL-ML	A-4	0	98-100	98-100	85-100	36-60	<30	NP-7
	29-55	Fine sandy loam, sandy clay loam.	SC, SM-SC, CL, CL-ML	A-4	0	98-100	98-100	85-100	36-55	20-30	4-10
	55-65	Weathered bedrock	---	---	---	---	---	---	---	---	---
KM:											
Kian-----------	0-5	Loamy fine sand, fine sandy loam.	SM, SM-SC	A-2-4, A-4	0	95-100	90-100	50-75	15-50	<25	NP-7
	5-26	Fine sandy loam	SM, SC, ML, CL	A-2-4, A-4	0	95-100	90-100	65-85	30-55	<30	NP-10
	26-60	Fine sandy loam, loamy fine sand, loam.	SM, SM-SC	A-2-4, A-4	0	95-100	90-100	50-70	15-40	<25	NP-7
Mantachie-------	0-13	Loam, fine sandy loam.	CL-ML, SM-SC, SM ML	A-4	0	95-100	90-100	60-85	40-60	<20	NP-5
	13-60	Loam, clay loam, silty clay loam.	CL, SC, SM-SC, CL-ML	A-4, A-6	0	95-100	90-100	80-95	45-80	20-40	5-15
KvA-------------- Kirbyville	0-12	Fine sandy loam	CL-ML, ML, CL	A-4	0	90-100	90-100	85-100	51-80	<25	NP-8
	12-72	Sandy clay loam, loam.	CL	A-6, A-4, A-7-6	0	90-100	90-100	85-100	51-85	25-42	8-25
LaB-------------- Laska	0-19	Fine sandy loam, loamy very fine sand.	SM, ML	A-4	0	98-100	98-100	80-100	40-60	<25	NP-3
	19-29	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4	0	98-100	98-100	80-100	40-60	<25	NP-7
	29-80	Fine sandy loam, loamy very fine sand, loamy fine sand.	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0	98-100	98-100	70-100	15-60	<25	NP-7
LgB-------------- Leggett	0-12	Fine sandy loam	SM, SM-SC, CL-ML, ML	A-4	0	95-100	95-100	70-100	36-65	<30	NP-7
	12-39	Sandy clay loam, clay loam, silty clay loam.	SC, CL	A-6, A-7-6	0	95-100	95-100	80-98	36-90	35-45	15-23
	39-72	Sandy clay loam, clay loam.	SC, CL	A-6, A-7-6	0	95-100	95-100	80-98	36-80	30-50	11-25
MoB-------------- Moswell	0-5	Fine sandy loam	ML, CL-ML	A-4	0	97-100	95-100	80-95	51-70	<30	NP-7
	5-22	Clay-------------	CH	A-7	0	97-100	95-100	90-100	85-99	65-95	35-65
	22-47	Clay, shaly clay	CH	A-7	0	97-100	95-100	90-100	85-99	70-95	40-65
	47-60	Shaly clay, very shaly clay, clay, shale.	CH	A-7	0	97-100	95-100	90-100	85-99	70-95	55-70
MoD-------------- Moswell	0-4	Fine sandy loam	ML, CL-ML	A-4	0	97-100	95-100	80-95	51-70	<30	NP-7
	4-25	Clay-------------	CH	A-7	0	97-100	95-100	90-100	85-99	65-95	35-65
	25-60	Clay, shaly clay	CH	A-7	0	97-100	95-100	90-100	85-99	70-95	40-65

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Na: Nahatche	0-6	Fine sandy loam	CL, SC	A-4, A-6	0	95-100	95-100	70-90	35-55	25-35	7-15
	6-72	Stratified loam, clay loam, fine sandy loam, very fine sandy loam, sandy clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	70-80	30-45	11-25
OaB: Oakhurst	0-7	Very fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4	0-5	90-100	80-100	80-100	36-65	<30	NP-7
	7-46	Clay, silty clay, clay loam, silty clay loam.	CH	A-7-6	0	90-100	90-100	90-100	70-95	51-70	30-45
	46-65	Clay, silty clay loam, clay loam, sandy clay loam.	CH, CL, SC	A-7-6	0	70-100	70-100	55-100	45-95	40-84	25-55
OaC: Oakhurst	0-7	Very fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4	0-5	90-100	80-100	80-100	36-65	<30	NP-7
	7-47	Clay, silty clay, clay loam, silty clay loam.	CH	A-7-6	0	90-100	90-100	90-100	70-95	51-70	30-45
	47-60	Clay, silty clay loam, clay loam, sandy clay loam.	CH, CL, SC	A-7-6	0	70-100	70-100	55-100	45-95	40-84	25-55
OtA: Otanya	0-9	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4	0	95-100	90-100	70-99	36-55	<25	NP-7
	9-28	Sandy clay loam, clay loam, fine sandy loam.	SC, CL	A-6, A-4	0	80-100	80-100	70-100	40-60	20-35	8-20
	28-48	Sandy clay loam, clay loam.	SC, CL	A-6, A-4	0	80-100	80-100	70-100	40-70	22-40	8-26
	48-65	Sandy clay loam, clay loam.	SC, CL	A-6, A-4	0	80-100	80-100	70-100	40-70	22-40	8-26
Oz:											
Ozias	0-5	Silty clay loam	CL, CH	A-7	0	98-100	98-100	96-100	80-98	41-55	20-33
	5-50	Clay, silty clay, silty clay loam, clay loam.	CH	A-7	0	99-100	98-100	97-100	85-100	51-70	25-40
	50-60	Clay, silty clay, silty clay loam, clay loam.	CH	A-7	0	99-100	98-100	97-100	85-100	51-70	25-40
Pophers	0-9	Silty clay loam	CL	A-6, A-7	0	98-100	98-100	96-100	80-98	25-45	11-20
	9-44	Silty clay loam, clay loam, loam.	CL	A-6, A-7	0	98-100	98-100	96-100	80-98	25-45	12-30
	44-60	Silty clay loam, clay loam, loam.	CL	A-6, A-7	0	98-100	98-100	96-100	80-98	25-45	12-30
PaB: Pinetucky	0-16	Loamy fine sand	SM	A-2-4	0	85-100	85-100	65-80	20-35	<20	NP-3
	16-32	Sandy clay loam, clay loam.	SC, CL	A-4, A-6	0	90-100	90-100	80-95	45-65	20-40	8-20
	32-60	Sandy clay loam, clay loam.	SC, CL	A-4, A-6	0	95-100	90-100	80-95	45-65	20-40	8-20

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
PfB-------------- Pinetucky	0-12	Fine sandy loam, sandy loam.	SM, SM-SC	A-4	0	85-100	85-100	65-80	36-45	<25	NP-7
	12-28	Sandy clay loam, clay loam.	SC, CL	A-4, A-6	0	90-100	90-100	80-95	45-65	20-40	8-20
	28-70	Sandy clay loam, clay loam.	SC, CL	A-4, A-6	0	95-100	90-100	80-95	45-65	20-40	8-20
PGB:											
Pinetucky-------	0-2	Fine sandy loam, sandy loam.	SM, SM-SC	A-4	0	85-100	85-100	65-80	36-45	<25	NP-7
	2-28	Sandy clay loam, clay loam.	SC, CL	A-4, A-6	0	90-100	90-100	80-95	45-65	20-40	8-20
	28-60	Sandy clay loam, clay loam.	SC, CL	A-4, A-6	0	95-100	90-100	80-95	45-65	20-40	8-20
Conroe----------	0-3	Gravelly loamy fine sand.	GM, SM-SC, SM, GP-GM	A-1, A-4, A-2-4	0	35-85	35-80	20-70	10-40	<25	NP-4
	3-60	Sandy clay, clay	CL, SC, CH	A-7-6	0	80-100	75-100	60-95	35-60	40-55	20-35
PK:											
Pluck-----------	0-6	Fine sandy loam, loam, silt loam.	SM, SC, ML, CL	A-2-4, A-4	0	98-100	95-100	60-85	30-75	<30	NP-10
	6-26	Fine sandy loam	SM, SC, ML, CL	A-2-4, A-4	0	98-100	95-100	60-85	30-55	<25	NP-10
	26-35	Sandy clay loam, loam, silt loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0	98-100	95-100	90-100	36-85	25-40	6-18
	35-52	Sandy clay loam, sandy loam, fine sandy loam.	CL-ML, CL, SM-SC, SC	A-2, A-4, A-6	0	98-100	95-100	70-95	30-60	22-40	5-16
	52-65	Silty clay loam, clay loam.	CL	A-6, A-7-6	0	98-100	95-100	90-100	70-95	32-42	12-20
Kian------------	0-4	Fine sandy loam, loamy fine sand.	SM, SM-SC, ML, CL-ML	A-2-4, A-4	0	95-100	90-100	50-85	15-55	<25	NP-7
	4-26	Fine sandy loam	SM, SC, ML, CL	A-2-4, A-4	0	95-100	90-100	65-85	30-55	<30	NP-10
	26-52	Fine sandy loam, loam, loamy fine sand.	SM, SM-SC	A-2-4, A-4	0	95-100	90-100	50-70	15-40	<25	NP-7
	52-65	Clay loam, sandy clay loam.	CL	A-6, A-7-6	0	95-100	90-100	90-100	70-80	32-42	12-20
Pp--------------- Pophers	0-2	Silty clay loam	CL	A-6, A-7	0	98-100	98-100	96-100	80-98	25-45	11-20
	2-20	Silty clay loam, clay loam, loam.	CL	A-6, A-7	0	98-100	98-100	96-100	80-98	25-45	12-30
	20-60	Silty clay loam, clay loam, loam.	CL	A-6, A-7	0	98-100	98-100	96-100	80-98	25-45	12-30
RaE, RaD--------- Rayburn	0-7	Fine sandy loam	CL-ML, ML, SM, SM-SC	A-4, A-2-4	0	100	100	70-99	25-65	<25	NP-7
	7-55	Clay, silty clay	CH	A-7	0	100	100	90-100	75-95	51-80	25-50
	55-62	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
SoA-------------- Sorter	0-14	Silt loam, very fine sandy loam.	ML, CL-ML	A-4	0	100	95-100	95-100	51-80	<20	NP-7
	14-52	Silt loam, loam	ML, CL-ML	A-4	0	100	95-100	95-100	51-80	<20	NP-7
	52-65	Silt loam, loam	CL-ML, CL	A-4, A-6	0	100	95-100	95-100	51-80	18-32	4-19

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
SpA---------------- Splendora	0-10	Very fine sandy loam, fine sandy loam, loam.	SM, SM-SC, ML, CL-ML	A-4	0	95-100	95-100	95-100	40-60	<20	NP-7
	10-22	Loam, fine sandy loam, sandy clay loam.	CL, CL-ML	A-4, A-6	0	95-100	85-100	80-100	51-80	20-30	7-16
	22-46	Sandy clay loam, loam, fine sandy loam.	CL, CL-ML	A-4, A-6	0	80-100	80-100	70-100	51-80	20-30	7-16
	46-95	Sandy clay loam, loam, fine sandy loam.	CL	A-6	0	80-100	80-100	70-100	51-80	25-35	12-20
SrB---------------- Spurger	0-8	Fine sandy loam, loam.	SM, ML, CL-ML, SM-SC	A-4	0	95-100	90-100	70-95	40-75	<25	NP-7
	8-31	Clay, clay loam	CH, CL	A-7-6	0	95-100	95-100	90-100	70-95	45-70	20-40
	31-56	Sandy clay loam, clay loam, loam.	CL, SC, SM-SC, CL-ML	A-4, A-6	0	95-100	90-100	80-100	45-95	20-40	4-20
	56-72	Stratified fine sandy loam to sand.	SM-SC, SM, SP-SM	A-2-4, A-4, A-3	0	95-100	90-100	50-95	5-50	<20	NP-7
SrD---------------- Spurger	0-3	Fine sandy loam, loam.	SM, ML, CL-ML, SM-SC	A-4	0	95-100	90-100	70-95	40-75	<25	NP-7
	3-48	Clay, clay loam	CH, CL	A-7-6	0	95-100	95-100	90-100	70-95	45-70	20-40
	48-62	Sandy clay loam, clay loam, loam.	CL, SC, SM-SC, CL-ML	A-4, A-6	0	95-100	90-100	80-100	45-95	20-40	4-20
STE: Stringtown-------	0-8	Fine sandy loam, loamy fine sand.	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0-1	90-100	85-100	70-85	15-55	<30	NP-7
	8-50	Sandy clay loam, clay loam.	SC, CL	A-4, A-6	0-1	80-100	70-100	65-100	36-65	20-40	8-20
	50-65	Variable----------	---	---	---	---	---	---	---	---	---
Bonwier----------	0-9	Fine sandy loam, sandy loam.	SM, ML, SM-SC, CL-ML	A-4	0-1	85-100	75-100	65-100	36-60	<30	NP-7
	9-26	Clay, sandy clay	CL, CH	A-7	0-1	85-100	75-100	65-100	51-98	45-60	25-38
	26-40	Variable----------	---	---	---	---	---	---	---	---	---
Vr, Vs------------ Voss	0-70	Sand, fine sand	SM-SC, SP-SM, SM	A-3, A-2-4	0	98-100	95-100	65-85	5-20	<25	NP-7
WaA---------------- Waller	0-6	Silt loam--------	ML, CL-ML	A-4	0	100	98-100	95-100	51-75	<25	NP-6
	6-35	Loam, silt loam, very fine sandy loam.	CL, CL-ML, ML	A-4, A-6	0	100	98-100	95-100	60-90	15-30	2-11
	35-60	Loam, silty clay loam, clay loam.	CL, CL-ML	A-4, A-6	0	100	98-100	95-100	60-90	20-40	4-20
WgB---------------- Wiergate	0-24	Clay--------------	CH	A-7-6	0	100	95-100	90-100	80-98	55-80	35-55
	24-60	Clay--------------	CH	A-7-6	0	98-100	95-100	90-100	80-98	55-85	35-60
WgC---------------- Wiergate	0-12	Clay--------------	CH	A-7-6	0	100	95-100	90-100	80-98	55-80	35-55
	12-60	Clay--------------	CH	A-7-6	0	98-100	95-100	90-100	80-98	55-85	35-60

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
WoB------------ Woodville	0-6	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0	95-100	95-100	75-98	36-70	<30	NP-7
	6-65	Clay-------------	CH	A-7	0	95-100	95-100	90-100	75-98	51-86	30-62
	65-70	Clay-------------	CH, CL	A-7	0	95-100	95-100	90-100	75-95	41-55	25-35
WoD------------ Woodville	0-5	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0	95-100	95-100	75-98	36-70	<30	NP-7
	5-65	Clay-------------	CH	A-7	0	95-100	95-100	90-100	75-98	51-86	30-62
	65-70	Clay-------------	CH, CL	A-7	0	95-100	95-100	90-100	75-95	41-55	25-35

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Organic matter
									K	T	
	In	Pct	G/cc	In/hr	In/in	pH	Mmhos/cm				Pct
BeB-------------- Bernaldo	0-19	5-15	1.40-1.60	2.0-6.0	0.11-0.15	5.1-6.5	<2	Low----------	0.28	5	<1
	19-41	18-30	1.50-1.70	0.6-2.0	0.15-0.20	4.5-6.5	<2	Moderate----	0.32		
	41-71	10-27	1.50-1.70	0.6-2.0	0.15-0.20	4.5-6.5	<2	Low----------	0.32		
	71-80	---	---	---	---	---	---	------------	----		
BeC-------------- Bernaldo	0-15	5-15	1.40-1.60	2.0-6.0	0.11-0.15	5.1-6.5	<2	Low----------	0.28	5	<1
	15-33	18-30	1.50-1.70	0.6-2.0	0.15-0.20	4.5-6.5	<2	Moderate----	0.32		
	33-60	10-27	1.50-1.70	0.6-2.0	0.15-0.20	4.5-6.5	<2	Low----------	0.32		
	60-65	---	---	---	---	---	---	------------	----		
BfB-------------- Betis	0-24	2-10	1.20-1.50	6.0-20	0.05-0.09	4.5-6.0	<2	Low----------	0.17	5	<1
	24-80	5-15	1.20-1.50	6.0-20	0.08-0.11	4.5-6.0	<2	Low----------	0.17		
BnB-------------- Bienville	0-24	5-15	1.35-1.60	2.0-6.0	0.08-0.11	4.5-6.5	<2	Low----------	0.20	5	<2
	24-80	5-20	1.35-1.80	2.0-6.0	0.08-0.13	4.5-6.0	<2	Low----------	0.20		
BoB-------------- Boykin	0-22	3-10	1.40-1.60	6.0-20	0.07-0.11	4.5-6.5	<2	Low----------	0.20	5	<1
	22-70	15-35	1.50-1.70	0.6-2.0	0.13-0.17	4.5-6.0	<2	Low----------	0.24		
BuD-------------- Burkeville	0-60	60-80	1.30-1.55	<0.06	0.15-0.18	7.9-8.4	<2	Very high	0.32	5	<2
CaB-------------- Choates	0-24	5-12	1.50-1.65	6.0-20	0.07-0.11	5.1-6.5	<2	Low----------	0.17	5	<1
	24-80	15-35	1.40-1.60	0.2-0.6	0.12-0.17	3.6-5.5	<2	Low----------	0.32		
CfB-------------- Colita	0-11	5-15	1.40-1.60	2.0-6.0	0.11-0.15	4.5-6.0	<2	Low----------	0.32	3	<1
	11-32	5-15	1.50-1.70	2.0-6.0	0.09-0.18	4.5-6.0	<2	Low----------	0.37		
	32-40	18-30	1.50-1.70	0.6-2.0	0.12-0.17	4.5-6.0	<2	Low----------	0.37		
	40-45	20-35	1.50-1.60	0.6-2.0	0.13-0.20	4.5-6.0	<2	Moderate----	0.32		
	45-60	---	1.20-1.40	---	---	---	---	------------	----		
ClB: Colita-----------	0-16	5-15	1.40-1.60	2.0-6.0	0.11-0.15	4.5-6.0	<2	Low----------	0.32	3	<1
	16-32	5-15	1.50-1.70	2.0-6.0	0.09-0.18	4.5-6.0	<2	Low----------	0.37		
	32-50	20-35	1.50-1.60	0.6-2.0	0.13-0.20	4.5-6.0	<2	Moderate----	0.32		
	50-60	---	1.20-1.40	---	---	---	---	------------	----		
Laska------------	0-33	5-10	1.30-1.50	2.0-6.0	0.11-0.15	3.6-6.0	<2	Low----------	0.32	5	<1
	33-63	8-15	1.30-1.50	2.0-6.0	0.11-0.15	4.5-6.0	<2	Low----------	0.32		
CpC: Colita-----------	0-7	5-15	1.30-1.50	2.0-6.0	0.11-0.15	4.5-6.0	<2	Low----------	0.37	3	<1
	7-11	5-15	1.35-1.55	2.0-6.0	0.09-0.15	4.5-6.0	<2	Low----------	0.37		
	11-18	18-35	1.30-1.60	0.6-2.0	0.13-0.20	4.5-6.0	<2	Moderate----	0.32		
	18-22	---	---	---	---	---	---	------------	----		
Kitterll---------	0-10	10-25	1.40-1.65	0.6-2.0	0.11-0.17	5.1-6.5	<2	Low----------	0.37	1	<2
	10-14	---	---	---	---	---	---	------------	----		
CrB, CrC--------- Conroe	0-22	2-10	1.40-1.60	2.0-6.0	0.04-0.10	4.5-6.5	<2	Very low----	0.15	5	<2
	22-26	30-45	1.50-1.65	0.06-0.2	0.10-0.20	4.5-5.5	<2	Moderate----	0.20		
	26-60	35-50	1.55-1.75	0.06-0.2	0.10-0.16	4.5-5.5	<2	Moderate----	0.17		
DaA-------------- Dallardsville	0-5	5-15	1.50-1.70	2.0-6.0	0.11-0.20	3.6-5.5	<2	Low----------	0.37	5	<1
	5-19	3-12	1.50-1.70	2.0-6.0	0.07-0.15	3.6-5.5	<2	Low----------	0.37		
	19-33	8-18	1.50-1.70	2.0-6.0	0.11-0.20	3.6-5.5	<2	Low----------	0.37		
	33-45	12-25	1.50-1.70	0.6-2.0	0.11-0.20	3.6-5.0	<2	Low----------	0.37		
	45-70	25-40	1.50-1.70	0.2-0.6	0.12-0.20	3.6-5.0	<2	Moderate----	0.32		

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	G/cc	In/hr	In/in	pH	Mmhos/cm				Pct
DbB: Diboll	0-22	3-10	1.50-1.70	0.2-0.6	0.10-0.20	4.5-6.5	<2	Low	0.55	3	<1
	22-39	18-35	1.35-1.50	0.2-0.6	0.12-0.17	5.1-8.4	<4	Moderate	0.37		
	39-45	25-40	1.35-1.50	<0.06	0.12-0.17	5.1-8.4	<4	Moderate	0.37		
	45-60	---	---	---	---	---	---	------------	----		
DkB:											
Diboll	0-20	3-10	1.50-1.70	0.2-0.6	0.10-0.20	4.5-6.5	<2	Low	0.55	3	<1
	20-36	18-35	1.35-1.50	0.2-0.6	0.12-0.17	5.1-8.4	<4	Moderate	0.37		
	36-60	---	---	---	---	---	---	------------	----		
Keltys	0-29	4-8	1.40-1.60	0.6-2.0	0.10-0.18	5.1-6.5	<2	Low	0.43	4	<1
	29-55	8-22	1.50-1.65	0.06-0.2	0.11-0.18	3.6-5.5	<2	Low	0.37		
	55-65	---	1.50-1.70	---	---	---	---	------------	----		
DoB: Doucette	0-22	3-10	1.40-1.60	6.0-20	0.07-0.11	5.1-6.0	<2	Low	0.20	5	<1
	22-70	20-35	1.50-1.70	0.6-2.0	0.13-0.17	4.5-5.5	<2	Low	0.24		
Fa: Fausse	0-1	---	0.05-0.25	>2.0	0.20-0.50	5.6-7.3	<2	Low	----	5	30-85
	1-42	60-95	1.10-1.45	<0.06	0.18-0.20	6.1-8.4	<2	Very high	0.24		
	42-60	35-95	1.10-1.45	<0.2	0.18-0.22	6.6-8.4	<2	Very high	0.24		
GaA: Garner	0-5	35-55	1.20-1.45	0.06-0.2	0.12-0.18	5.6-7.8	<2	High	0.32	5	1-4
	5-65	50-60	1.30-1.50	<0.06	0.12-0.18	5.6-8.4	<2	High	0.32		
GaB: Garner	0-3	35-55	1.20-1.45	0.06-0.2	0.12-0.18	5.6-7.8	<2	High	0.32	5	1-4
	3-65	50-60	1.30-1.50	<0.06	0.12-0.18	5.6-8.4	<2	High	0.32		
Ha: Hatliff	0-6	8-25	1.20-1.50	2.0-6.0	0.12-0.17	5.1-7.3	<2	Low	0.24	5	<1
	6-70	8-18	1.20-1.50	2.0-6.0	0.05-0.11	5.1-7.3	<2	Low	0.24		
Hf: Hatliff	0-11	8-25	1.20-1.50	2.0-6.0	0.12-0.17	5.1-7.3	<2	Low	0.24	5	<1
	11-80	8-18	1.20-1.50	2.0-6.0	0.05-0.11	5.1-7.3	<2	Low	0.24		
HrB: Herty	0-2	6-15	1.20-1.40	0.6-2.0	0.11-0.20	4.5-6.0	<2	Low	0.49	5	<1
	2-39	35-45	1.40-1.60	0.06-0.2	0.12-0.18	3.6-5.5	<2	High	0.37		
	39-46	40-70	1.20-1.50	<0.06	0.12-0.20	3.6-5.0	2-8	High	0.37		
	46-60	40-70	1.15-1.35	<0.06	0.12-0.20	3.6-5.0	4-8	High	0.37		
HrC: Herty	0-7	6-15	1.20-1.40	0.6-2.0	0.11-0.20	4.5-6.0	<2	Low	0.49	5	<1
	7-36	35-45	1.40-1.60	0.06-0.2	0.12-0.18	3.6-5.5	<2	High	0.37		
	36-48	40-70	1.20-1.50	<0.06	0.12-0.20	3.6-5.0	2-8	High	0.37		
	48-60	40-70	1.15-1.35	<0.06	0.12-0.20	3.6-5.0	4-8	High	0.37		
Ka, Kf: Kaman	0-72	40-60	1.30-1.50	<0.06	0.15-0.20	5.6-7.8	<2	High	0.32	5	1-3
KlB: Keltys	0-29	4-8	1.40-1.60	0.6-2.0	0.10-0.18	5.1-6.5	<2	Low	0.43	4	<1
	29-55	8-22	1.50-1.65	0.06-0.2	0.11-0.18	3.6-5.5	<2	Low	0.37		
	55-65	---	1.50-1.70	---	---	---	---	------------	----		
KM:											
Kian	0-5	3-20	1.20-1.50	2.0-6.0	0.08-0.15	5.1-7.3	<2	Low	0.17	5	<1
	5-26	8-20	1.30-1.50	2.0-6.0	0.11-0.15	5.1-7.3	<2	Low	0.20		
	26-60	5-15	1.30-1.50	2.0-6.0	0.10-0.15	5.6-7.3	<2	Low	0.20		
Mantachie	0-13	8-20	1.50-1.60	0.6-2.0	0.16-0.20	4.5-5.5	<2	Low	0.28	5	1-3
	13-60	18-34	1.50-1.60	0.6-2.0	0.14-0.20	4.5-5.5	<2	Low	0.28		
KvA: Kirbyville	0-12	5-15	1.50-1.70	2.0-6.0	0.11-0.15	4.5-6.0	<2	Low	0.32	5	<1
	12-72	18-30	1.50-1.70	0.6-2.0	0.15-0.20	4.5-5.5	<2	Low	0.28		

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	T	Organic matter
	In	Pct	G/cc	In/hr	In/in	pH	Mmhos/cm				Pct
LaB----------------	0-19	5-10	1.30-1.50	2.0-6.0	0.11-0.15	3.6-6.0	<2	Low----------	0.32	5	<1
Laska	19-29	8-15	1.30-1.50	2.0-6.0	0.11-0.15	4.5-6.0	<2	Low----------	0.32		
	29-80	5-15	1.35-1.60	2.0-6.0	0.07-0.15	5.1-7.3	<2	Low----------	0.32		
LgB----------------	0-12	10-15	1.30-1.50	0.6-2.0	0.11-0.20	4.5-6.0	<2	Low----------	0.24	5	<1
Leggett	12-39	28-35	1.35-1.60	0.6-2.0	0.12-0.18	4.5-6.0	<2	Moderate-----	0.28		
	39-72	20-40	1.35-1.60	0.6-2.0	0.12-0.18	4.5-6.0	<2	Moderate-----	0.28		
MoB----------------	0-5	8-12	1.25-1.50	0.6-2.0	0.12-0.18	4.5-6.0	<2	Low----------	0.49	5	<1
Moswell	5-22	60-70	1.20-1.40	<0.06	0.11-0.17	3.6-5.5	<2	High---------	0.32		
	22-47	60-70	1.20-1.40	<0.06	0.08-0.11	3.6-5.0	2-8	High---------	0.32		
	47-60	60-80	1.20-1.40	<0.06	0.08-0.11	3.6-5.5	2-8	High---------	0.32		
MoD----------------	0-4	8-12	1.25-1.50	0.6-2.0	0.12-0.18	4.5-6.0	<2	Low----------	0.49	5	<1
Moswell	4-25	60-70	1.20-1.40	<0.06	0.11-0.17	3.6-5.5	<2	High---------	0.32		
	25-60	60-70	1.20-1.40	<0.06	0.08-0.11	3.6-5.0	2-8	High---------	0.32		
Na-----------------	0-6	15-25	1.10-1.30	0.6-2.0	0.10-0.15	5.1-7.8	<2	Moderate-----	0.28	5	1-3
Nahatche	6-72	18-35	1.30-1.60	0.6-2.0	0.10-0.15	5.1-7.8	<2	Moderate-----	0.28		
OaB----------------	0-7	10-20	1.20-1.50	0.6-2.0	0.11-0.18	5.1-6.5	<2	Low----------	0.43	5	<2
Oakhurst	7-46	35-50	1.20-1.40	<0.06	0.12-0.18	5.1-7.8	<2	High---------	0.32		
	46-65	30-60	1.30-1.50	<0.06	0.10-0.16	6.1-8.4	<2	High---------	0.37		
OaC----------------	0-7	10-20	1.20-1.50	0.6-2.0	0.11-0.18	5.1-6.5	<2	Low----------	0.43	5	<2
Oakhurst	7-47	35-50	1.20-1.40	<0.06	0.12-0.18	5.1-7.8	<2	High---------	0.32		
	47-60	30-60	1.30-1.50	<0.06	0.10-0.16	6.1-8.4	<2	High---------	0.37		
OtA----------------	0-9	5-18	1.40-1.60	2.0-6.0	0.10-0.15	4.5-6.5	<2	Low----------	0.28	5	<1
Otanya	9-28	12-25	1.50-1.70	0.6-2.0	0.15-0.20	4.5-5.5	<2	Low----------	0.32		
	28-48	23-35	1.50-1.70	0.2-0.6	0.15-0.20	4.5-5.5	<2	Low----------	0.32		
	48-65	23-35	1.65-1.80	0.2-0.6	0.15-0.20	4.5-5.5	<2	Low----------	0.28		
Oz:											
Ozias------------	0-5	30-40	1.35-1.50	0.06-0.2	0.15-0.18	3.6-5.0	<8	High---------	0.32	5	<2
	5-50	35-60	1.35-1.50	<0.06	0.12-0.16	3.6-9.0	<8	High---------	0.32		
	50-60	35-60	1.35-1.50	<0.06	0.12-0.16	3.6-9.0	<8	High---------	0.32		
Pophers----------	0-9	20-40	1.35-1.55	0.2-0.6	0.14-0.20	3.6-5.5	<4	Moderate-----	0.49	5	<2
	9-44	20-35	1.40-1.60	0.2-0.6	0.12-0.18	3.6-5.5	<8	Moderate-----	0.49		
	44-60	20-45	1.40-1.60	0.06-0.2	0.10-0.15	3.6-5.5	<8	Moderate-----	0.49		
PaB----------------	0-16	5-15	1.40-1.60	6.0-20	0.07-0.11	4.5-6.0	<2	Low----------	0.24	5	<1
Pinetucky	16-32	20-35	1.50-1.70	0.2-0.6	0.15-0.20	4.5-5.5	<2	Low----------	0.32		
	32-60	20-35	1.60-1.70	0.2-0.6	0.15-0.20	4.5-5.5	<2	Low----------	0.28		
PfB----------------	0-12	8-20	1.40-1.60	2.0-6.0	0.10-0.15	4.5-6.0	<2	Low----------	0.32	5	<1
Pinetucky	12-28	20-35	1.50-1.70	0.2-0.6	0.15-0.20	4.5-5.5	<2	Low----------	0.32		
	28-70	20-35	1.60-1.70	0.2-0.6	0.15-0.20	4.5-5.5	<2	Low----------	0.28		
PGB:											
Pinetucky--------	0-2	8-20	1.40-1.60	2.0-6.0	0.10-0.15	4.5-6.0	<2	Low----------	0.32	5	<1
	2-28	20-35	1.50-1.70	0.2-0.6	0.15-0.20	4.5-5.5	<2	Low----------	0.32		
	28-60	20-35	1.60-1.75	0.2-0.6	0.15-0.20	4.5-5.5	<2	Low----------	0.28		
Conroe-----------	0-3	2-10	1.40-1.60	2.0-6.0	0.04-0.10	4.5-6.5	<2	Very low-----	0.15	5	<1
	3-60	35-50	1.55-1.75	0.06-0.2	0.10-0.16	4.5-5.5	<2	Moderate-----	0.17		

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	G/cc	In/hr	In/in	pH	Mmhos/cm				Pct
PK:											
Pluck-----------	0-6	8-20	1.10-1.30	2.0-6.0	0.11-0.18	5.1-6.5	<2	Low---------	0.20	5	<2
	6-26	12-20	1.20-1.50	2.0-6.0	0.11-0.15	5.1-7.8	<2	Low---------	0.20		
	26-35	20-35	1.20-1.50	0.6-2.0	0.16-0.20	5.1-7.8	<2	Moderate----	0.32		
	35-52	15-30	1.20-1.50	0.6-2.0	0.10-0.18	5.1-7.8	<2	Moderate----	0.28		
	52-65	27-40	1.20-1.50	0.6-2.0	0.17-0.22	5.6-7.8	<2	Moderate----	0.32		
Kian------------	0-4	3-20	1.20-1.50	2.0-6.0	0.08-0.15	5.1-7.3	<2	Low---------	0.20	5	<1
	4-26	8-20	1.30-1.50	2.0-6.0	0.11-0.15	5.1-7.3	<2	Low---------	0.20		
	26-52	5-15	1.30-1.50	2.0-6.0	0.10-0.15	5.6-7.3	<2	Low---------	0.20		
	52-65	20-35	1.30-1.50	0.6-2.0	0.13-0.18	5.6-7.8	<2	Moderate----	0.32		
Pp--------------- Pophers	0-2	20-40	1.35-1.55	0.2-0.6	0.14-0.20	3.6-5.5	<4	Moderate----	0.49	5	<2
	2-20	20-35	1.40-1.60	0.2-0.6	0.12-0.18	3.6-5.5	<8	Moderate----	0.49		
	20-60	20-45	1.40-1.60	0.06-0.2	0.10-0.15	3.6-5.5	<8	Moderate----	0.49		
RaB, RaD--------- Rayburn	0-7	8-20	1.20-1.40	0.6-2.0	0.11-0.15	4.5-6.0	<2	Low---------	0.43	3	<1
	7-55	40-60	1.30-1.50	<0.06	0.12-0.18	3.6-5.5	<2	High--------	0.37		
	55-62	---	---	---	---	---	---	------------	----		
SoA-------------- Sorter	0-14	3-10	1.60-1.80	0.6-2.0	0.15-0.20	5.6-7.3	<2	Low---------	0.43	5	<1
	14-52	10-18	1.65-1.85	0.06-0.2	0.15-0.20	4.5-6.0	<2	Low---------	0.49		
	52-65	15-20	1.65-1.85	0.06-0.2	0.15-0.20	4.5-6.0	<2	Low---------	0.49		
SpA-------------- Splendora	0-10	3-15	1.60-1.75	0.6-2.0	0.10-0.18	5.1-6.0	<2	Low---------	0.43	5	<2
	10-22	18-24	1.65-1.75	0.6-2.0	0.09-0.17	4.5-5.5	<2	Low---------	0.37		
	22-46	18-30	1.65-1.75	0.2-0.6	0.09-0.14	4.5-5.5	<2	Low---------	0.32		
	46-95	18-30	1.70-1.85	0.06-0.2	0.07-0.11	4.5-5.5	<2	Low---------	0.32		
SrB-------------- Spurger	0-8	8-18	1.10-1.40	0.6-2.0	0.11-0.20	4.5-5.5	<2	Low---------	0.43	5	<2
	8-31	35-60	1.20-1.50	0.06-0.2	0.12-0.18	4.5-5.5	<2	Moderate----	0.32		
	31-56	18-35	1.20-1.50	0.2-0.6	0.12-0.17	4.5-5.5	<2	Low---------	0.32		
	56-72	2-20	1.20-1.50	0.6-6.0	0.05-0.15	4.5-5.5	<2	Low---------	0.32		
SrD-------------- Spurger	0-3	8-18	1.10-1.40	0.6-2.0	0.11-0.20	4.5-5.5	<2	Low---------	0.43	5	<2
	3-48	35-60	1.20-1.50	0.06-0.2	0.12-0.18	4.5-5.5	<2	Moderate----	0.32		
	48-62	18-35	1.20-1.50	0.2-0.6	0.12-0.17	4.5-5.5	<2	Low---------	0.32		
STE:											
Stringtown------	0-8	5-18	1.20-1.40	0.6-2.0	0.09-0.15	4.5-6.5	<2	Low---------	0.32	3	<1
	8-50	18-35	1.35-1.55	0.6-2.0	0.15-0.20	4.5-6.0	<2	Low---------	0.28		
	50-65	---	---	---	---	---	---	------------	----		
Bonwier---------	0-9	8-20	1.20-1.40	2.0-6.0	0.11-0.15	4.5-6.0	<2	Low---------	0.32	3	<1
	9-26	40-60	1.30-1.50	0.2-0.6	0.12-0.18	4.5-5.5	<2	Moderate----	0.32		
	26-40	---	---	---	---	---	---	------------	----		
Vr, Vs----------- Voss	0-70	2-10	1.40-1.60	6.0-20	0.02-0.06	5.6-7.3	<2	Low---------	0.15	5	<1
WaA-------------- Waller	0-6	5-15	1.50-1.65	0.6-2.0	0.15-0.20	4.5-6.0	<2	Low---------	0.43	5	<2
	6-35	5-15	1.55-1.70	0.06-0.2	0.15-0.20	4.5-6.0	<2	Low---------	0.43		
	35-60	18-30	1.50-1.70	0.6-2.0	0.15-0.20	5.6-7.3	<2	Low---------	0.37		
WgB-------------- Wiergate	0-24	50-80	1.20-1.45	<0.06	0.15-0.18	6.6-7.8	<2	Very high	0.32	5	1-4
	24-60	60-80	1.30-1.50	<0.06	0.15-0.18	7.9-8.4	<2	Very high	0.32		
WgC-------------- Wiergate	0-12	50-80	1.20-1.45	<0.06	0.15-0.18	6.6-7.8	<2	Very high	0.32	5	1-4
	12-60	60-80	1.30-1.50	<0.06	0.15-0.18	7.9-8.4	<2	Very high	0.32		
WoB-------------- Woodville	0-6	5-18	1.20-1.40	0.6-2.0	0.13-0.18	4.5-6.5	<2	Low---------	0.43	5	<1
	6-65	40-60	1.40-1.60	<0.06	0.12-0.18	4.5-5.5	<2	High--------	0.32		
	65-70	40-60	1.40-1.60	<0.06	0.12-0.18	5.1-8.4	<2	High--------	0.32		

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	G/cc	In/hr	In/in	pH	Mmhos/cm				Pct
WoD--------------- Woodville	0-5	5-18	1.20-1.40	0.6-2.0	0.13-0.18	4.5-6.5	<2	Low----------	0.43	5	<1
	5-65	40-60	1.40-1.60	<0.06	0.12-0.18	4.5-5.5	<2	High---------	0.32		
	65-70	40-60	1.40-1.60	<0.06	0.12-0.18	5.1-8.4	<2	High---------	0.32		

TABLE 17.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Map symbol and soil name	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
BeB, BeC---------- Bernaldo	B	None--------	---	---	4.0-6.0	Apparent	Nov-Feb	>60	---	Moderate	Moderate.
BfB--------------- Betis	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate.
BnB--------------- Bienville	A	None--------	---	---	4.0-6.0	Apparent	Dec-Apr	>60	---	Low------	Moderate.
BoB--------------- Boykin	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High.
BuD--------------- Burkeville	D	None--------	---	---	0-2.0	Perched	Jan-Mar	>60	---	High-----	Low.
CaB--------------- Choates	C	None--------	---	---	1.5-2.5	Apparent	Jan-Mar	>60	---	High-----	High.
CfB--------------- Colita	D	None--------	---	---	0.5-2.0	Perched	Nov-Apr	40-60	Soft	High-----	Moderate.
ClB:											
Colita-----------	D	None--------	---	---	0.5-2.0	Perched	Nov-Apr	40-60	Soft	High-----	Moderate.
Laska------------	B	None--------	---	---	1.5-3.0	Apparent	Dec-Apr	>60	---	Moderate	High.
CpC:											
Colita-----------	D	None--------	---	---	1.0-2.0	Perched	Nov-Apr	15-40	Soft	High-----	Moderate.
Kitterll---------	D	None--------	---	---	>6.0	---	---	4-14	Soft	Low------	Moderate.
CrB, CrC---------- Conroe	B	None--------	---	---	2.0-3.5	Perched	Nov-May	>60	---	High-----	High.
DaA--------------- Dallardsville	C	None--------	---	---	1.0-2.0	Perched	Dec-Apr	>60	---	High-----	High.
DbB--------------- Diboll	D	None--------	---	---	0.5-1.5	Perched	Jan-Apr	40-60	Soft	High-----	High.
DkB:											
Diboll-----------	D	None--------	---	---	0.5-1.5	Perched	Jan-Apr	40-60	Soft	High-----	High.
Keltys-----------	B	None--------	---	---	2.5-3.5	Perched	Jan-Apr	40-60	Soft	High-----	High.
DoB--------------- Doucette	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High.
Fa*--------------- Fausse	D	Frequent----	Brief to very long.	Jan-Dec	+1.-0.5	Apparent	Jan-Dec	>60	---	High-----	Low.
GaA, GaB---------- Garner	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
Ha: Hatliff	C	Rare	---	---	0-2.0	Apparent	Nov-Mar	>60	---	Low	Moderate.
Hf: Hatliff	C	Frequent	Brief	Nov-May	0-2.0	Apparent	Nov-Mar	>60	---	Low	Moderate.
HrB, HrC: Herty	D	None	---	---	0-0.5	Perched	Jan-Apr	>60	---	High	High.
Ka: Kaman	D	Rare	---	---	0-2.5	Apparent	Sep-Jul	>60	---	High	Moderate.
Kf: Kaman	D	Frequent	Long	Nov-Jun	0-2.5	Apparent	Sep-Jul	>60	---	High	Moderate.
KlB: Keltys	B	None	---	---	2.5-3.5	Perched	Jan-Apr	40-60	Soft	High	High.
KM:											
Kian	C	Frequent	Long	Dec-Apr	0-1.5	Apparent	Dec-Jun	>60	---	High	Moderate.
Mantachie	C	Frequent	Brief	Jan-Mar	1.0-1.5	Apparent	Dec-Mar	>60	---	High	High.
KvA: Kirbyville	B	None	---	---	1.5-2.5	Apparent	Jan-Mar	>60	---	High	Moderate.
LaB: Laska	B	None	---	---	1.5-3.0	Apparent	Dec-Apr	>60	---	Moderate	High.
LgB: Leggett	C	None	---	---	0.5-1.5	Apparent	Dec-Mar	>60	---	High	High.
MoB, MoD: Moswell	D	None	---	---	3.5-5.0	Apparent	Jan-Mar	>60	---	High	High.
Na: Nahatche	C	Rare	---	---	0-1.5	Apparent	Nov-May	>60	---	High	Moderate.
OaB, OaC: Oakhurst	D	None	---	---	0-1.0	Perched	Nov-Apr	>60	---	High	Moderate.
OtA: Otanya	B	None	---	---	3.0-5.0	Perched	Dec-Apr	>60	---	High	High.
Oz:											
Ozias	D	Frequent	Long	Dec-May	1.0-2.0	Apparent	Nov-May	>60	---	High	High.
Pophers	C	Frequent	Long	Jan-Jun	1.0-2.0	Apparent	Dec-May	>60	---	High	High.
PaB, PfB: Pinetucky	B	None	---	---	>6.0	---	---	>60	---	High	High.
PGB:											
Pinetucky	C	None	---	---	>6.0	---	---	>60	---	High	High.
Conroe	B	None	---	---	2.0-3.5	Perched	Nov-May	>60	---	High	High.
PK:											
Pluck	C	Frequent	Long	Dec-Mar	0-1.5	Apparent	Dec-Apr	>60	---	High	High.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
PK:											
Kian	C	Frequent	Long	Dec-Apr	0-1.5	Apparent	Dec-Jun	>60	---	High	Moderate.
Pp: Pophers	C	Frequent	Long	Jan-Jun	1.0-2.0	Apparent	Dec-May	>60	---	High	High.
RaB, RaD: Rayburn	D	None	---	---	2.5-4.5	Perched	Dec-Feb	40-60	Soft	High	High.
SoA*: Sorter	D	None	---	---	+.5-2.5	Perched	Oct-May	>60	---	High	High.
SpA: Splendora	C	None	---	---	0.5-2.0	Perched	Dec-May	>60	---	High	High.
SrB, SrD: Spurger	C	None	---	---	2.5-3.5	Perched	Dec-Feb	>60	---	High	High.
STE:											
Stringtown	B	None	---	---	>6.0	---	---	>60	---	Moderate	High.
Bonwier	C	None	---	---	>6.0	---	---	>60	---	High	High.
Vr: Voss	B	Rare	---	---	2.0-5.0	Apparent	Oct-May	>60	---	Low	Moderate.
Vs: Voss	B	Frequent	Brief	Oct-Mar	2.0-5.0	Apparent	Oct-May	>60	---	Low	Moderate.
WaA: Waller	B/D	None	---	---	0-2.5	Apparent	Nov-Jun	>60	---	High	Moderate.
WgB, WgC: Wiergate	D	None	---	---	0-2.0	Perched	Jan-Mar	>60	---	High	Low.
WoB, WoD: Woodville	D	None	---	---	2.5-4.0	Apparent	Dec-Feb	>60	---	High	High.

* In the "High water table--Depth column," a plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

TABLE 18.--ENGINEERING INDEX TEST DATA

[Dashes indicate data were not available. NP means nonplastic]

Soil name, sample number, horizon and depth in inches	Classification		Grain-size distribution: Percentage passing sieve-- 1/						Percentage smaller than--			Liquid limit 2/	Plasticity index 2/	Particle density	Shrinkage		
	AASHTO	Unified	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm				Limit	Linear	Ratio
												Pct		G/cc	Pct	Pct	Pct
Bernaldo fine sandy loam 3/:																	
(S76TX-407-1)																	
A -- 0 to 4	A-4 (0)	SM-SC	100	100	100	100	99	43	35	5	3	25	4	2.61	22.0	2.0	1.63
Bt1 -- 19 to 29	A-6 (3)	CL	100	100	100	100	100	68	58	36	34	39	24	2.66	15.0	11.3	1.83
E/Bt-- 41 to 57	A-4 (0)	SM	100	100	100	100	100	28	17	4	4	24	3	2.64	21.0	1.3	1.63
Bienville loamy fine sand 4/:																	
(S76TX-373-5)																	
Ap -- 0 to 6	A-2-4 (0)	SM	100	100	100	100	99	29	23	4	3	19	3	2.63	16.0	0.0	1.70
B/E -- 26 to 44	A-2-4 (0)	SM	100	100	100	100	99	31	25	5	4	14	1	2.64	14.0	0.0	1.87
Choates loamy fine sand 5/:																	
(S76TX-373-3)																	
A -- 0 to 4	A-2-4 (0)	SM	100	100	100	100	99	18	13	4	2	28	3	2.60	26.0	0.0	1.45
Bt2 -- 37 to 72	A-2-7 (2)	SC	100	100	100	100	100	34	34	30	29	43	22	2.67	20.0	10.2	1.68
Colita fine sandy loam 3/:																	
(S76TX-373-2)																	
A1 -- 0 to 5	A-4 (0)	ML	100	100	100	100	100	58	43	6	5	21	3	2.62	19.0	1.1	1.71
Btg -- 40 to 45	A-4 (1)	CL-ML	100	100	100	100	100	61	48	14	12	23	6	2.63	17.0	3.4	1.76
Cr -- 45 to 47	A-2-7 (0)	GW-GC	81	64	38	21	9	6	5	2	2	42	19	2.61	22.0	8.8	1.64

See footnotes at end of table.

TABLE 18.--ENGINEERING INDEX TEST DATA--Continued

Soil name, sample number, horizon and depth in inches	Classification		Grain-size distribution: Percentage passing sieve-- 1/						Grain-size distribution: Percentage smaller than--			Liquid limit 2/	Plasticity index 2/	Particle density	Shrinkage		
	AASHTO	Unified	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm				Limit	Linear	Ratio
												Pct		G/cc	Pct	Pct	Pct
Conroe gravelly loamy fine sand 6/, 7/: (S76TX-407-3)																	
Ac -- 0 to 5	A-1-6 (0)	GM-GC	96	85	51	40	34	14	12	2	1	27	6	2.60	22.0	2.7	1.62
Btvc-- 30 to 42	A-2-7 (3)	SC	84	76	66	60	50	28	27	20	20	47	31	2.69	16.0	14.0	1.85
Btv2-- 55 to 70	A-2-7 (4)	SC	95	92	88	86	64	35	33	28	28	48	30	2.66	17.0	13.8	1.79
Garner clay 3/: (S76TX-373-6)																	
A -- 0 to 5	A-7-6 (40)	CH	100	100	100	100	98	95	92	69	58	58	36	2.67	10.0	20.2	2.02
BCg -- 26 to 65	A-7-6 (45)	CH	100	100	100	100	98	96	94	73	64	62	40	2.68	10.0	21.6	2.06
Otanya fine sandy loam 8/: (S76TX-373-7)																	
A -- 0 to 6	A-4 (0)	SM	100	100	100	100	99	45	36	6	3	16	2	2.64	15.0	0.5	1.83
Btv1-- 31 to 37	A-6 (9)	CL	100	100	100	100	99	59	54	27	23	31	19	2.67	14.0	8.8	1.92
Btv2-- 37 to 62	A-6 (8)	CL	100	99	98	97	96	54	47	23	22	34	22	2.67	14.0	10.3	1.92
Sorter silt loam 3/: (S76TX-407-2)																	
A -- 0 to 4	A-4 (0)	ML	100	100	100	100	95	59	50	7	4	18	2	2.63	17.0	0.8	1.81
Btg1-- 14 to 31	A-4 (0)	CL-ML	100	100	100	100	95	60	48	11	8	18	4	2.65	14.0	2.3	1.87
B/C -- 52 to 65	A-6 (12)	CL	100	100	100	99	96	73	68	28	19	30	19	2.66	13.0	9.0	1.93
Woodville fine sandy loam 9/, 10/: (S76TX-373-4)																	
A -- 0 to 8	A-4 (0)	SM-SC	100	100	100	100	98	36	31	14	12	28	6	2.59	20.0	4.3	1.67
Bt3 -- 41 to 50	A-7-6 (72)	CH	100	100	100	100	99	98	98	91	81	86	62	2.75	11.0	26.7	2.03

See footnotes at end of table.

TABLE 18.--ENGINEERING INDEX TEST DATA--Continued

1/ For soil materials larger than 3/8 inch, square mesh wire sieves were used that are slightly larger than equivalent round sieves, but the difference does not seriously affect the data.

2/ Liquid limit and plasticity index values were determined by the AASHTO-89 and AASHTO-90 methods except that the soil was added to water.

3/ See the section "Soil Series and Their Morphology" for the location of the pedon.

4/ From U.S. Highway 59 in Livingston, 10 miles west on U.S. Highway 190, 3,000 feet west and north on subdivision road, 600 feet west, 400 feet north, 400 feet east, 900 feet north.

5/ From U.S. Highway 59 in Livingston, 2.2 miles west on U.S. Highway 190, 2.2 miles north on Farm Road 350, 3.5 miles west to powerline clearing, 0.2 mile south.

6/ From Texas Highway 150, 8.6 miles southeast on Farm Road 945 to Pleasant Grove, 2.6 miles southwest, cross Farm Road 1725, 0.4 mile southwest, 1.35 miles south, 0.4 mile west, 30 feet south.

7/ This pedon is considered to be a taxadjunct to the Conroe series because it is more red and has a higher percent of gravel than is typical for the Conroe series.

8/ From U.S. Highway 190 in Livingston, 9 miles southeast on Texas Highway 146, 0.4 mile west on subdivision road, 200 feet south.

9/ From U.S. Highway 190, at Onalaska, 2.1 miles south on Farm Road 3186, 70 feet east.

10/ This pedon is considered to be a taxadjunct to the Woodville series because it is more alkaline and contains more clay than is typical for the Woodville series.

TABLE 19.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Bernaldo	Fine-loamy, siliceous, thermic Glossic Paleudalfs
Betis	Sandy, siliceous, thermic Psammentic Paleudults
Bienville	Sandy, siliceous, thermic Psammentic Paleudalfs
Bonwier	Clayey, mixed, thermic Typic Hapludults
Boykin	Loamy, siliceous, thermic Arenic Paleudults
Burkeville	Very-fine, montmorillonitic, thermic Aquentic Chromuderts
Choates	Loamy, siliceous, thermic Arenic Plinthaquic Paleudults
Colita	Fine-loamy, siliceous, thermic Typic Glossaqualfs
Colita Variant	Fine-loamy, siliceous, thermic Aeric Ochraqualfs
Conroe	Clayey, kaolinitic, thermic Arenic Plinthic Paleudults
Dallardsville	Coarse-loamy, siliceous, thermic Aquic Paleudults
Diboll	Fine-silty, siliceous, thermic Albic Glossic Natraqualfs
Doucette	Loamy, siliceous, thermic Arenic Plinthic Paleudults
Fausse	Very-fine, montmorillonitic, nonacid, thermic Typic Fluvaquents
Garner	Fine, montmorillonitic, thermic Entic Pelluderts
Hatliff	Coarse-loamy, mixed, nonacid, thermic Aquic Udifluvents
Herty	Fine, montmorillonitic, thermic Vertic Albaqualfs
Kaman	Fine, montmorillonitic, thermic Typic Pelluderts
Keltys	Coarse-loamy, siliceous, thermic Aquic Glossudalfs
Kian	Coarse-loamy, siliceous, nonacid, thermic Aeric Fluvaquents
Kirbyville	Fine-loamy, siliceous, thermic Plinthaquic Paleudults
Kitterll	Loamy, siliceous, nonacid, thermic, shallow Typic Udorthents
Laska	Coarse-loamy, siliceous, thermic Aquic Hapludalfs
Leggett	Fine-loamy, siliceous, thermic Aeric Glossaqualfs
Mantachie	Fine-loamy, siliceous, acid, thermic Aeric Fluvaquents
Moswell	Fine, montmorillonitic, thermic Vertic Paleudalfs
Nahatche	Fine-loamy, mixed, nonacid, thermic Aeric Fluvaquents
Oakhurst	Fine, montmorillonitic, thermic Vertic Albaqualfs
Otanya	Fine-loamy, siliceous, thermic Plinthic Paleudults
Ozias	Fine, mixed, acid, thermic Aeric Fluvaquents
Pinetucky	Fine-loamy, siliceous, thermic Plinthic Paleudults
Pluck	Fine-loamy, siliceous, nonacid, thermic Typic Fluvaquents
Pophers	Fine-silty, siliceous, acid, thermic Aeric Fluvaquents
Rayburn	Fine, montmorillonitic, thermic Vertic Hapludalfs
Sorter	Coarse-loamy, siliceous, thermic Typic Ochraqualfs
Splendora	Fine-loamy, siliceous, thermic Fragic Glossudalfs
Spurger	Fine, mixed, thermic Albaquultic Hapludalfs
Stringtown	Fine-loamy, siliceous, thermic Typic Hapludults
Voss	Mixed, thermic Aquic Udipsamments
Waller	Fine-loamy, siliceous, thermic Typic Glossaqualfs
Wiergate	Very-fine, montmorillonitic, thermic Typic Pelluderts
Woodville	Fine, montmorillonitic, thermic Vertic Paleudalfs

TABLE 20.--RELATIONSHIP OF THE GENERAL SOIL MAP UNITS TO THE GEOLOGIC UNITS

Map unit symbol and name	Topography	Geologic unit	Age
11--Kaman-Hatliff-Nahatche 10--Hatliff-Pluck-Kiam 13--Pophers-Ozias 12--Kian-Mantachie	Bottom land or flood plain.	Holocene alluvium	Holocene.
14--Bienville-Bernaldo-Spurger *	Stream terrace (underlain by fluviatile material).	Deweyville Formation	Late Pleistocene.
14--Bienville-Bernaldo-Spurger **	Stream terrace (underlain by fluviatile material).	Beaumont Formation ***	Pleistocene.
15--Garner *	Stream terrace (strath or cut).	Fleming Formation (surface may be correlative with Beaumont Formation).	Cut in Pleistocene time in Miocene-age materials.
8--Otanya-Kirbyville-Dallardsville 9--Sorter-Otanya-Waller	Upland, low relief, poorly drained.	Bentley Formation (or Lower Lissie).	Pleistocene.
5--Conroe 2--Woodville-Pinetucky 1--Pinetucky-Doucette 4--Wiergate-Burkeville-Woodville **	Upland, hilly, well drained.	Willis Formation	Plio-Pleistocene.
4--Wiergate-Burkeville-Woodville * 2--Woodville-Pinetucky 1--Pinetucky-Doucette 15--Garner **	Upland, hilly, well drained.	Fleming Formation	Miocene.
3--Laska-Colita-Oakhurst	Upland, hilly, well drained.	Catahoula Formation	Late Oligocene to Early Miocene.
6--Diboll-Moswell-Keltys 7--Moswell-Keltys	Upland, hilly, well drained.	Upper part of Jackson Group: Wellborn, Manning, and Whitsett Formations.	Late Eocene.

* Most of this unit has the topography and is of the geologic unit and age shown in this table.

** Part of this unit has the topography and is of the geologic unit and age shown in this table.

*** This formation is in question by some geologist.

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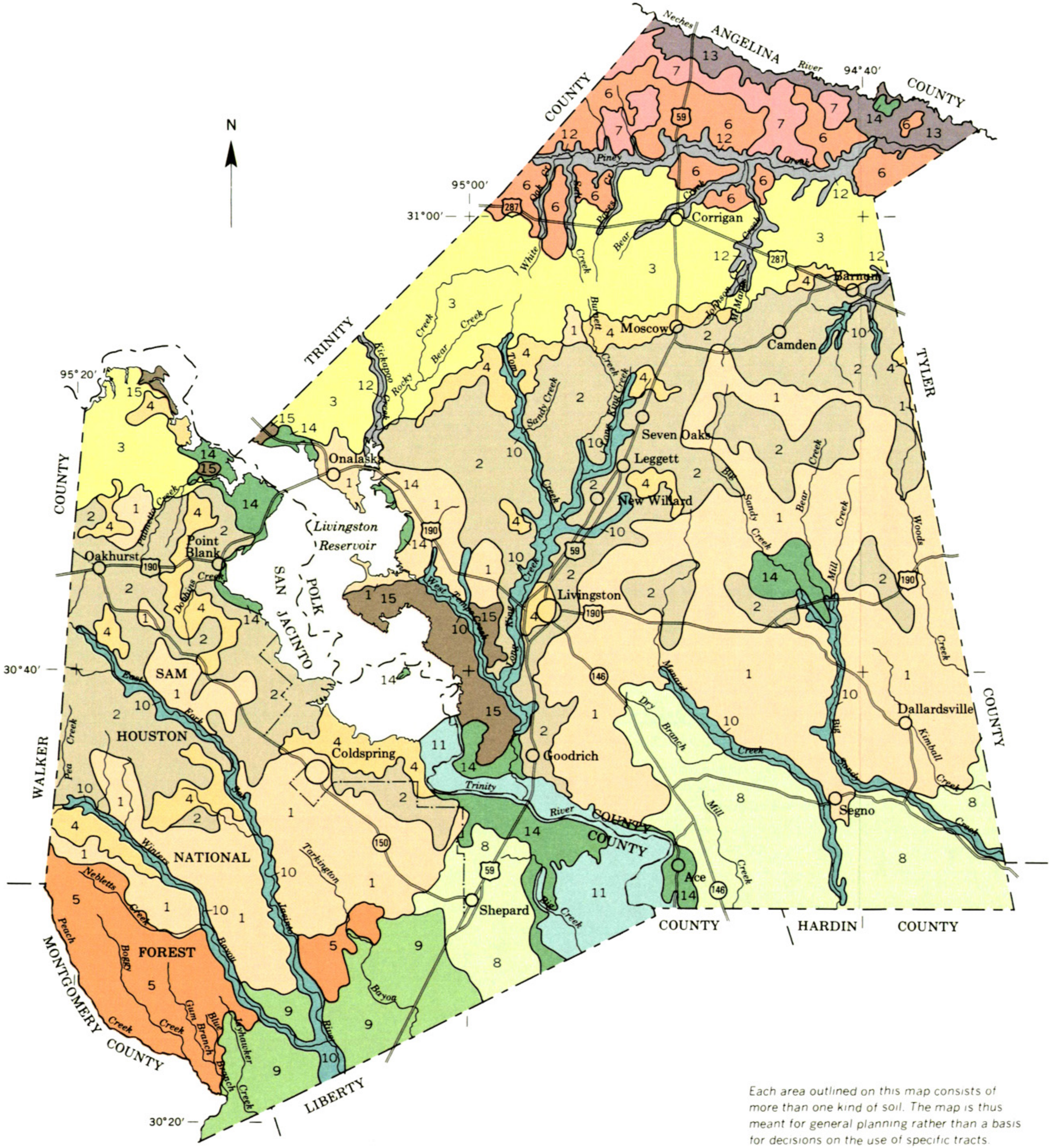


LEGEND*

MODERATELY WELL DRAINED TO SOMEWHAT POORLY DRAINED, LOAMY, SANDY, AND CLAYEY SOILS; ON UPLANDS

1 Pinetucky-Doucette: Gently sloping, moderately well drained and well drained, moderately slowly permeable and moderately permeable, loamy and sandy soils

2 Woodville-Pinetucky: Gently sloping to strongly sloping, somewhat poorly drained and moderately well drained, very slowly permeable and moderately slowly permeable, loamy soils

3 Laska-Colita-Oakhurst: Nearly level to strongly sloping, moderately well drained and somewhat poorly drained, moderately rapidly permeable, moderately permeable, and very slowly permeable, loamy soils

4 Wiergate-Burkeville-Woodville: Gently sloping to strongly sloping, somewhat poorly drained, very slowly permeable, clayey and loamy soils

5 Conroe: Gently sloping, moderately well drained, slowly permeable, gravelly and sandy soils

6 Diboll-Moswell-Keltys: Nearly level to strongly sloping, somewhat poorly drained and moderately well drained, very slowly permeable and slowly permeable, silty and loamy soils

7 Moswell-Keltys: Gently sloping to strongly sloping, moderately well drained, very slowly permeable and slowly permeable, loamy soils

MODERATELY WELL DRAINED TO POORLY DRAINED, LOAMY, SANDY, AND SILTY SOILS; ON FLATWOODS

8 Otanya-Kirbyville-Dallardsville: Nearly level to gently sloping, moderately well drained and somewhat poorly drained, moderately slowly permeable and moderately permeable, loamy and sandy soils

9 Sorter-Otanya-Waller: Nearly level to gently sloping, poorly drained and moderately well drained, slowly permeable and moderately slowly permeable, silty and loamy soils

MODERATELY WELL DRAINED TO POORLY DRAINED, LOAMY, CLAYEY, SANDY, AND SILTY SOILS; ON FLOOD PLAINS

10 Hatliff-Pluck-Kian: Nearly level to gently sloping, moderately well drained to poorly drained, moderately rapidly permeable and moderately permeable, loamy soils

11 Kaman-Hatliff-Nahatche: Nearly level to gently sloping, moderately well drained to poorly drained, very slowly permeable, moderately rapidly permeable, and moderately permeable, clayey and loamy soils

12 Kian-Mantachie: Nearly level to gently sloping, poorly drained and somewhat poorly drained, moderately permeable, sandy and loamy soils

13 Pophers-Ozias: Nearly level, somewhat poorly drained, slowly permeable and very slowly permeable silty soils

SOMEWHAT EXCESSIVELY DRAINED TO POORLY DRAINED, SANDY, LOAMY, AND CLAYEY SOILS; ON TERRACES

14 Bienville-Bernaldo-Spurger: Nearly level to strongly sloping, somewhat excessively drained to moderately well drained, moderately rapidly permeable, moderately permeable, and slowly permeable, sandy and loamy soils

15 Garner: Nearly level to gently sloping, poorly drained, very slowly permeable, clayey soils

* Unless otherwise indicated, the texture given in these descriptive headings refers to the surface layer of major soils.

COMPILED 1985

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE AND FOREST SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION

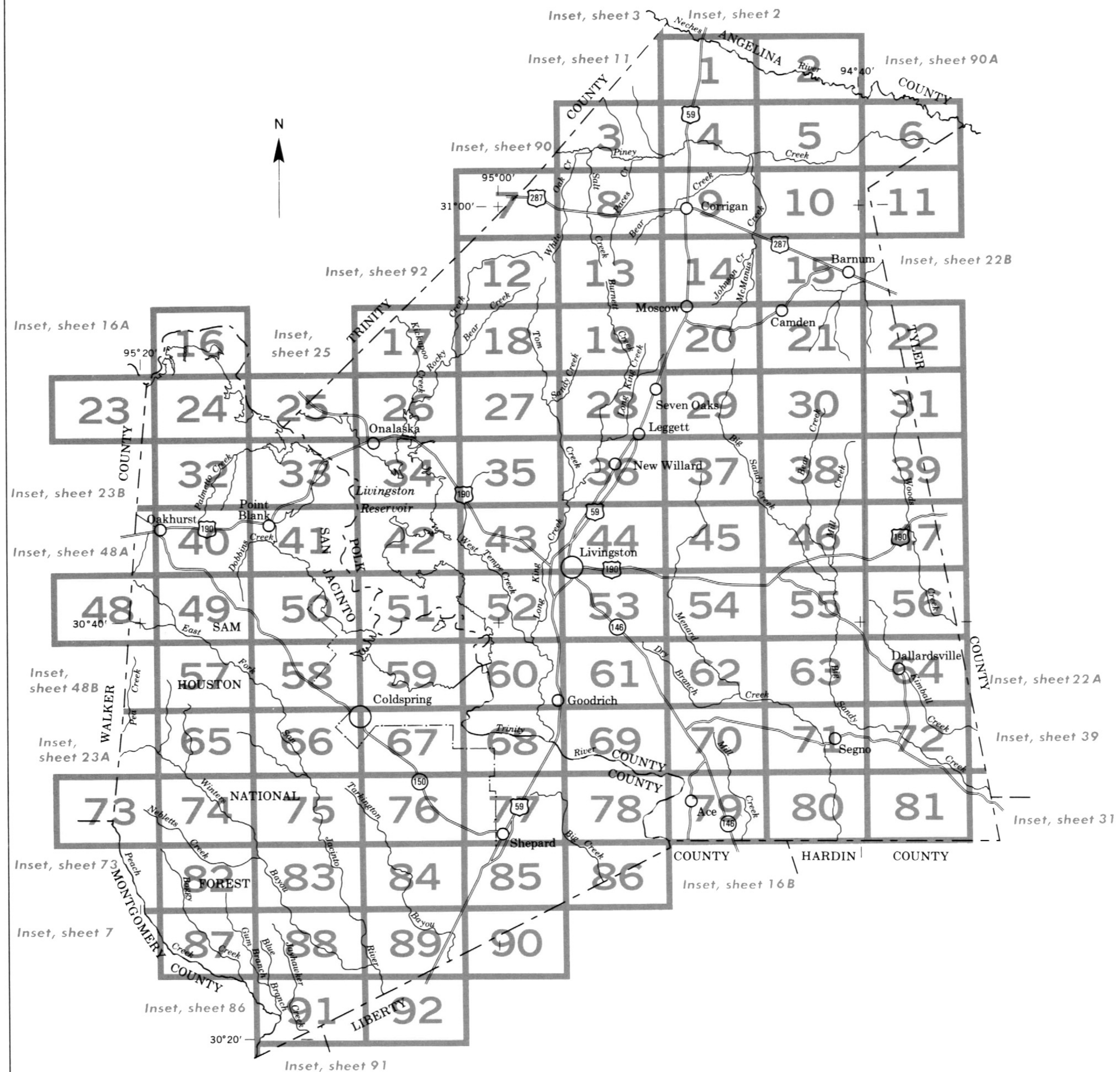
GENERAL SOIL MAP

POLK AND SAN JACINTO COUNTIES, TEXAS

Scale 1:380,160

1 0 1 2 3 4 5 6 Miles

1 0 6 12 Km



Original text from each individual map sheet read:
This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

INDEX TO MAP SHEETS
POLK AND SAN JACINTO COUNTIES, TEXAS

Scale 1:380,160

1 0 1 2 3 4 5 6 Miles

1 0 6 12 Km

SOIL LEGEND

Soil map publication symbols and map unit names are listed alphabetically. Map symbols are letters. The first letter is always a capital and is the initial letter of the soil name. The second letter is lower case except for broadly defined map units, in which case it is a capital. Broadly defined map units are also indicated by the footnote 1/. The third letter, where used, is a capital and denotes slope class. Symbols without the third letter are for nearly level soils.

BeB	Bernaldo fine sandy loam, 0 to 3 percent slopes
BeC	Bernaldo fine sandy loam, 3 to 8 percent slopes
BfB	Betis loamy fine sand, 1 to 5 percent slopes
BnB	Bienville loamy fine sand, 0 to 3 percent slopes
BoB	Boykin loamy fine sand, 1 to 5 percent slopes
BuD	Burkeville clay, 5 to 15 percent slopes
CaB	Choates loamy fine sand, 1 to 5 percent slopes
CfB	Colita fine sandy loam, 0 to 3 percent slopes
ClB	Colita-Laska complex, 1 to 5 percent slopes
CpC	Colita Variant-Kitterll complex, 1 to 8 percent slopes
CrB	Conroe gravelly loamy fine sand, 1 to 5 percent slopes
CrC	Conroe gravelly loamy fine sand, 5 to 8 percent slopes
DaA	Dallardsville loamy very fine sand, 0 to 2 percent slopes
DbB	Diboll silt loam, 0 to 3 percent slopes
DkB	Diboll-Keltys complex, 1 to 5 percent slopes
DoB	Doucette loamy fine sand, 1 to 5 percent slopes
Fa	Fausse clay, frequently flooded
GaA	Garner clay, 0 to 1 percent slopes
GaB	Garner clay, 1 to 5 percent slopes
Ha	Hatliff loam, rarely flooded
Hf	Hatliff loam, frequently flooded
HrB	Herty silt loam, 1 to 3 percent slopes
HrC	Herty silt loam, 3 to 5 percent slopes
Ka	Kaman clay, rarely flooded
Kf	Kaman clay, frequently flooded
KlB	Keltys very fine sandy loam, 1 to 5 percent slopes
KM	Kian and Mantachie soils, frequently flooded 1/
KvA	Kirbyville fine sandy loam, 0 to 2 percent slopes
LaB	Laska fine sandy loam, 1 to 5 percent slopes
LgB	Leggett fine sandy loam, 0 to 3 percent slopes
MoB	Moswell fine sandy loam, 1 to 5 percent slopes
MoD	Moswell fine sandy loam, 5 to 12 percent slopes
Na	Nahatche fine sandy loam, rarely flooded
OaB	Oakhurst very fine sandy loam, 1 to 5 percent slopes
OaC	Oakhurst very fine sandy loam, 5 to 8 percent slopes
OtA	Otanya fine sandy loam, 0 to 3 percent slopes
Oz	Ozias-Pophers complex, frequently flooded
PaB	Pinetucky loamy fine sand, 1 to 5 percent slopes
PfB	Pinetucky fine sandy loam, 1 to 5 percent slopes
PGB	Pinetucky and Conroe soils, graded 1/
PK	Pluck and Kian soils, frequently flooded 1/
Pp	Pophers silty clay loam, frequently flooded
RaB	Rayburn fine sandy loam, 1 to 5 percent slopes
RaD	Rayburn fine sandy loam, 5 to 15 percent slopes
SoA	Sorter silt loam, 0 to 1 percent slopes
SpA	Splendora very fine sandy loam, 0 to 2 percent slopes
SrB	Spurger fine sandy loam, 1 to 5 percent slopes
SrD	Spurger fine sandy loam, 5 to 15 percent slopes
STE	Stringtown-Bonwier association, strongly sloping 1/
Vr	Voss sand, rarely flooded
Vs	Voss sand, frequently flooded
WaA	Waller silt loam, 0 to 1 percent slopes
WgB	Wiergate clay, 1 to 5 percent slopes
WgC	Wiergate clay, 5 to 8 percent slopes
WoB	Woodville fine sandy loam, 1 to 5 percent slopes
WoD	Woodville fine sandy loam, 5 to 12 percent slopes

1/ Broadly defined map units. Fewer soil examinations were made in mapping units, and delineations and included areas are generally larger. The mapping units were designed primarily for woodland management.

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

National, state or province

County or parish

Minor civil division

Reservation (national forest or park, state forest or park, and large airport)

Land grant

Limit of soil survey (label)

Field sheet matchline & neatline

AD HOC BOUNDARY (label) — Hedley Airstrip

Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

Divided (median shown if scale permits)

Other roads

Trail

ROAD EMBLEM & DESIGNATIONS

Interstate — 21

Federal — 173

State — 28

County, farm or ranch — 1283

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

Without road

With road

With railroad

DAMS

Large (to scale)

Medium or small — water — w

PITS

Gravel pit

Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

Farmstead, house (omit in urban areas)

Church

School

Indian mound (label) — Indian Mound

Located object (label) — Tower

Tank (label) — Gas

Wells, oil or gas

Windmill

Kitchen midden

WATER FEATURES

DRAINAGE

Perennial, double line

Perennial, single line

Intermittent

Drainage end

Canals or ditches

Double-line (label) — CANAL

Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

Perennial — water — w

Intermittent — int — i

MISCELLANEOUS WATER FEATURES

Marsh or swamp

Spring

Well, artesian

Well, irrigation

Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — CaB — WgB

ESCARPMENTS

Bedrock (points down slope)

Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) — S

MISCELLANEOUS

Blowout

Clay spot

Gravelly spot

Gumbo, slick or scabby spot (sodic)

Dumps and other similar non soil areas

Prominent hill or peak

Rock outcrop (includes sandstone and shale)

Saline spot

Sandy spot

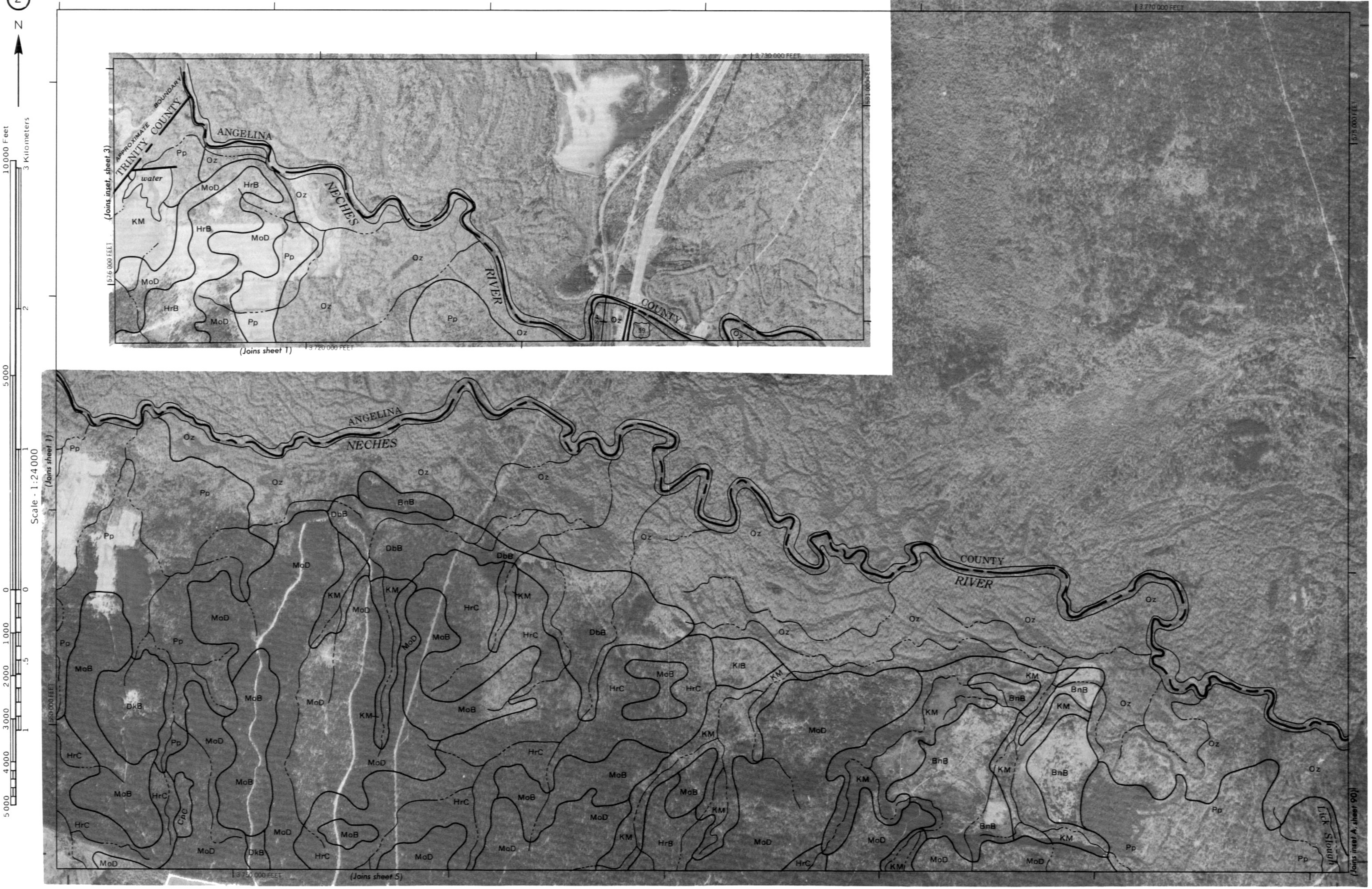
Severely eroded spot

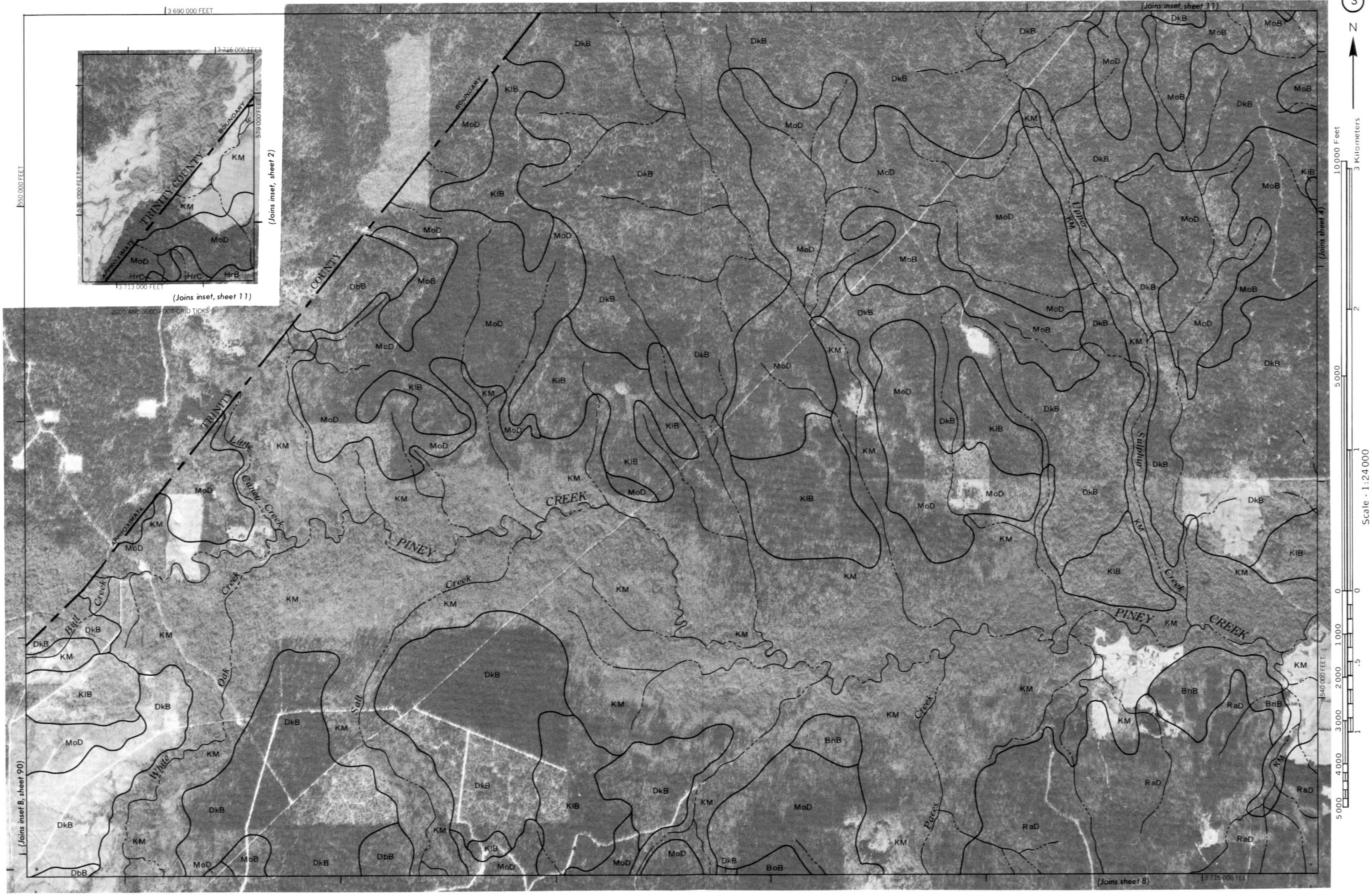
Slide or slip (tips point upslope)

Stony spot, very stony spot


(Joins inset, sheet 2)
3 720 000 FEET
ANGELINA
NECHES
COUNTY
RIVER
PACIFIC
SOUTHERN
Wakefield
Rocky
Creek
Lower
Sulphur
Creek
water
(Joins sheet 2)
(Joins inset, sheet 11)
(Joins sheet 4)
3 745 000 FEET
59
357
1987
MoD
HrB
Pp
Oz
KM
MoB
DkB
DbB
HrC
CpC
KlB
MoB
N
10000 Feet
3 Kilometers
Scale - 1:24 000

POLK AND SAN JACINTO COUNTIES, TEXAS — SHEET NUMBER 2



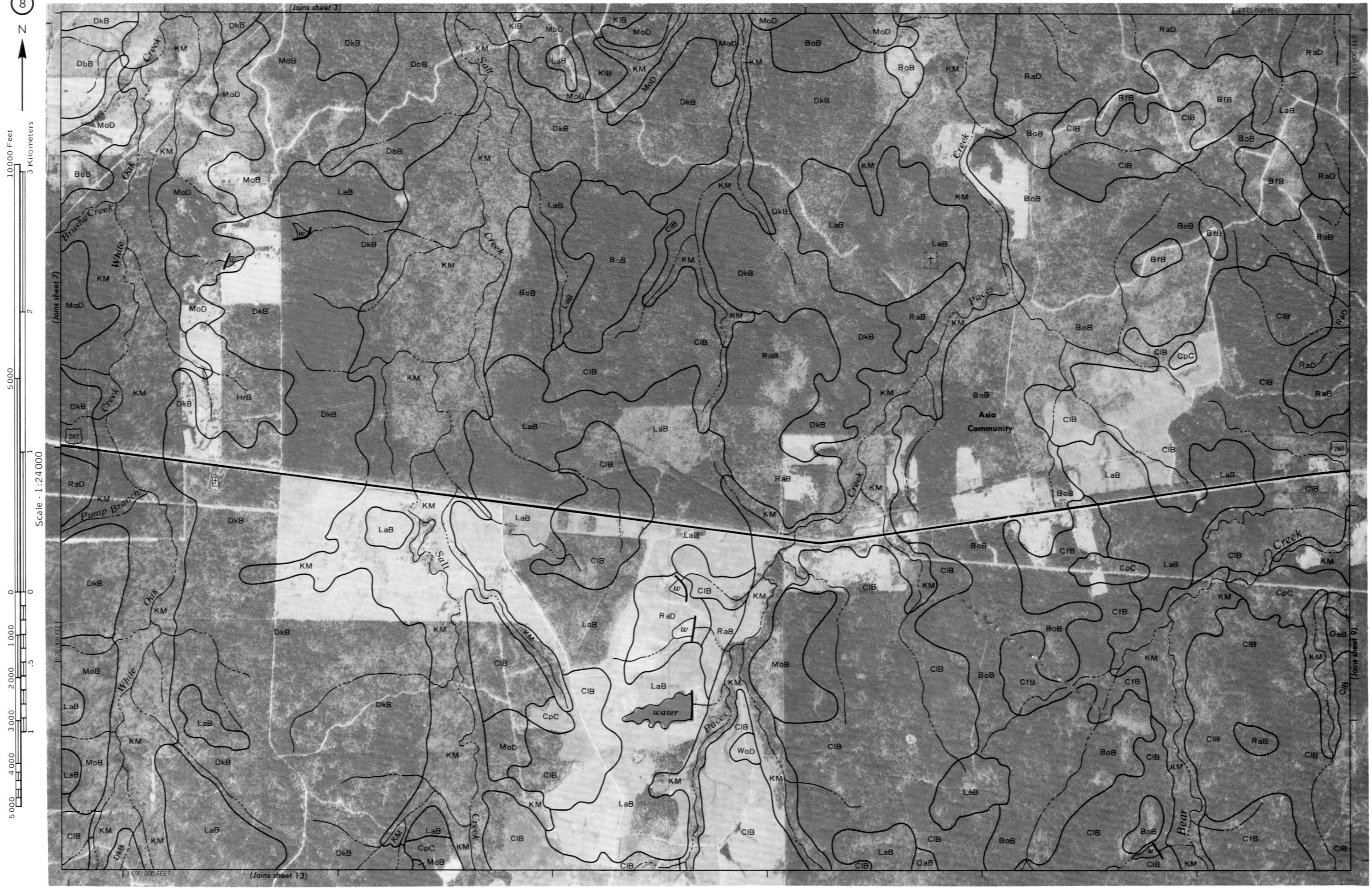

3
N
(Joins inset, sheet 11)
3 690 000 FEET
3 715 000 FEET
579 000 FEET
576 000 FEET
550 000 FEET
3 713 000 FEET
(Joins inset, sheet 2)
(Joins inset, sheet 11)
2000 AND 3000-FOOT GRID TICKS
TRINITY COUNTY
BOUNDARY
APPROXIMATE
COUNTY
TRINITY
Little Caney Creek
PINEY CREEK
Upper KM
Sulphur Creek
Bull Creek
Creek
Oak
White
Salt Creek
Paces Creek
(Joins sheet 4)
(Joins sheet 8)
(Joins inset B, sheet 90)
540 000 FEET
3 715 000 FEET
DkB
MoD
MoB
KM
KlB
DbB
BnB
RaD
BoB
HrC
HrB
10 000 Feet
3 Kilometers
5000
0
1000
2000
3000
4000
5000
2
1
.5
Scale - 1:24 000


N
10 000 Feet
3 Kilometers
Scale - 1:24 000
(Joins sheet 1)
(Joins sheet 3)
(Joins sheet 5)
(Joins sheet 9)
3 745 000 FEET
3 720 000 FEET
Rocky
Lower
Sulphur
Creek
Sandy
Branch
CREEK
PINEY
PINEY
Creek
CREEK
McManus
Creek
Creek
Bear
59
59
1987
1987
1987
MoB
DkB
KM
MoD
KlB
HrC
HrB
CpC
BnB
BoB
DbB
RaD
RaB

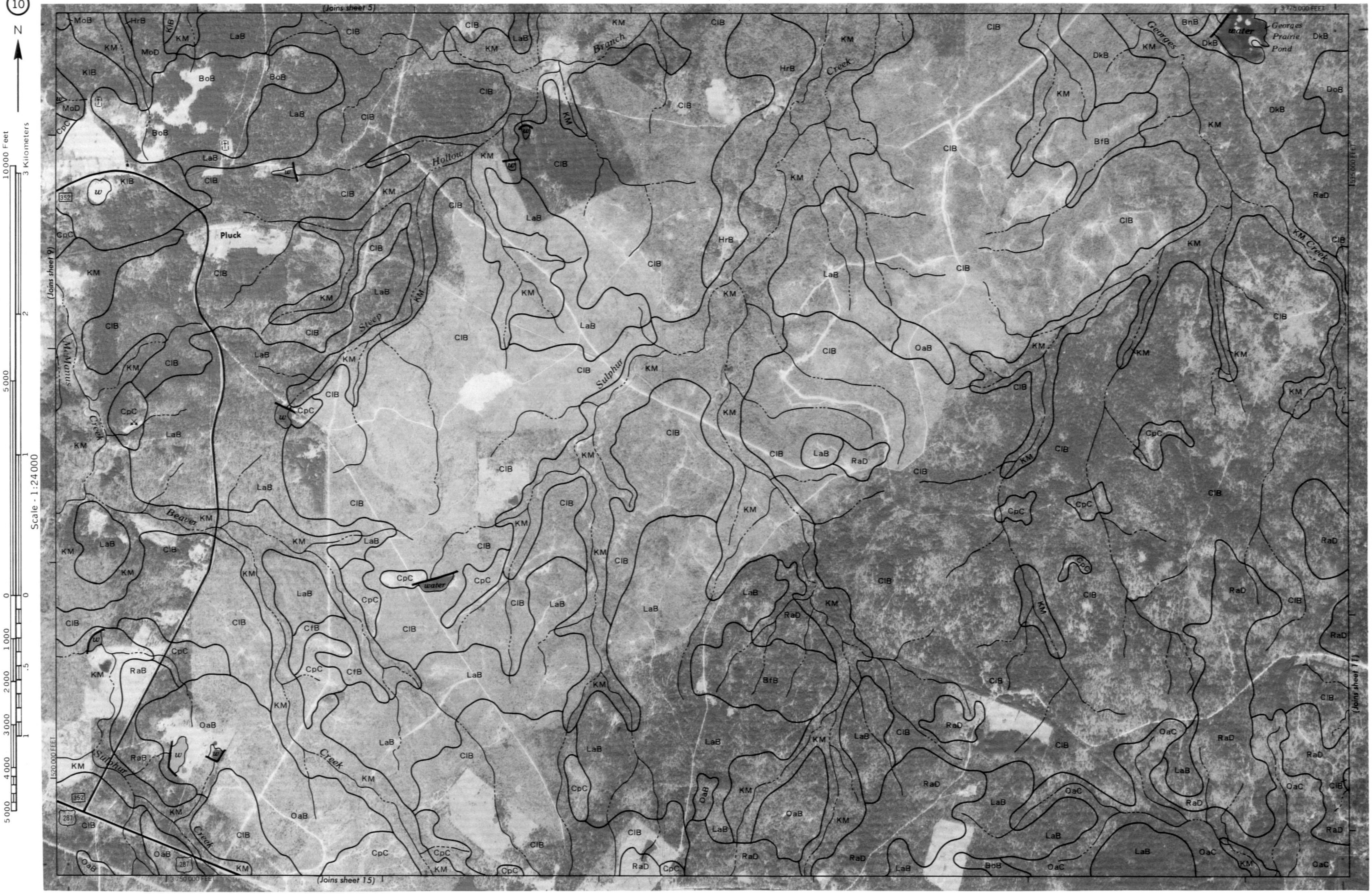

(Joins sheet 2)
(Joins sheet 6)
(Joins sheet 10)
(Joins sheet 4)
5
N
Scale - 1:24 000
Bowers Community
Georges Prairie Pond
PINEY CREEK
School Branch
Big
Saxon
Jones Branch
Double Slough
Lick Slough
Steen Hollow Branch
Sulphur Creek
Georges Creek

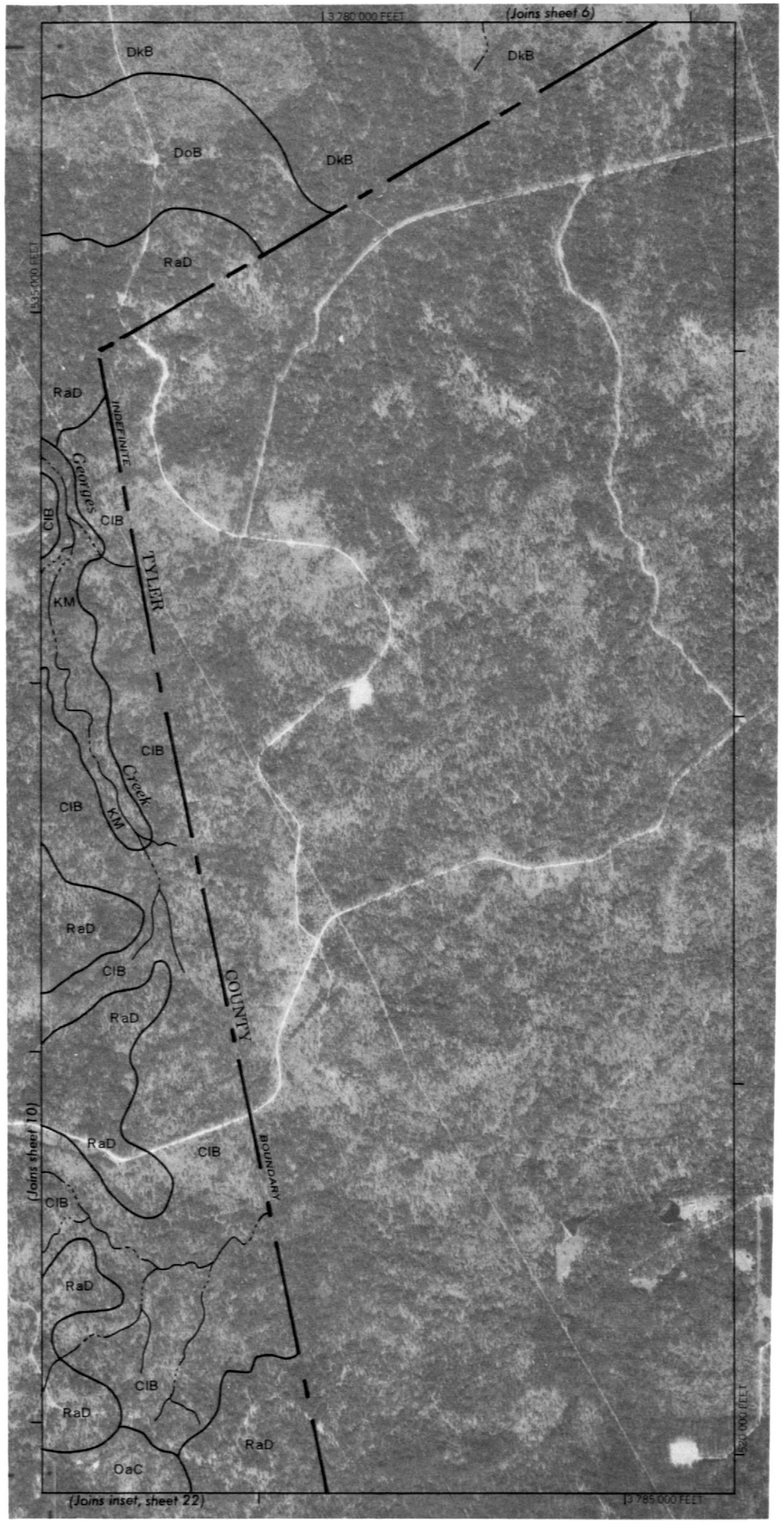

(Joins inset A, sheet 90)
(Joins sheet 5)
(Joins sheet 11)
N
Scale - 1:24000
Oz
BnB
Pp
DkB
KM
KlB
Peach Ridge
Howell Lake
PINEY CREEK
Lick
Slough
Creek
Howell
Sandy Branch
ANGELINA
NECHES
RIVER
TYLER COUNTY
COUNTY BOUNDARY
INDEFINITE

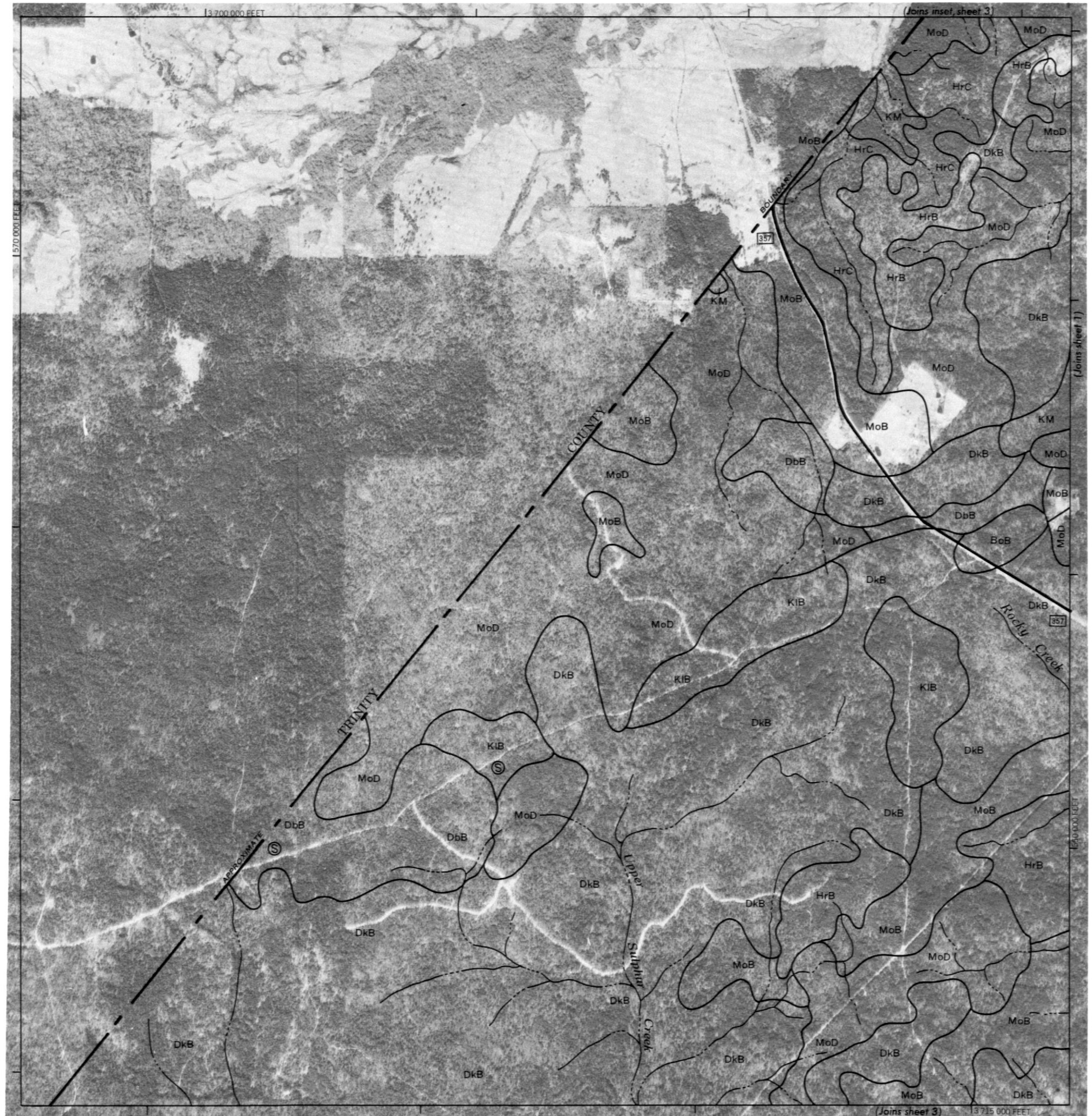

7
N
(Joins inset B, sheet 90)
(Joins sheet 8)
(Joins sheet 12)
(Joins inset, sheet 73)
(Joins sheet 87)
MONTGOMERY COUNTY
TRINITY APPROXIMATE BOUNDARY COUNTY
2000 AND 5000-FOOT GRID TICKS
Carmona Community
Brushy
Creek
Branch
Pump
Bull
water
287
1782
DbB
DkB
MoD
MoB
BoB
KM
KlB
CfB
ClB
LaB
RaD
OaB
CrB
PK
CaC
w
Scale - 1:24 000
10 000 Feet
5000
0
1000
2000
3000
4000
5 000
3 Kilometers
2
1
.5
0

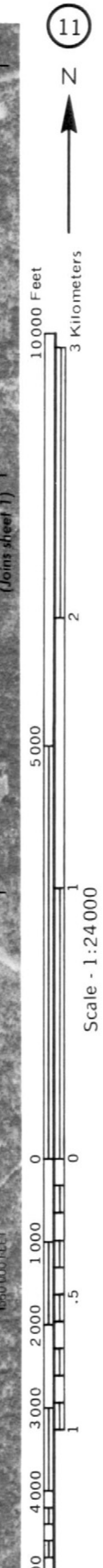

N
10 000 Feet
3 Kilometers
Scale 1:24 000
(Joins sheet 3)
(Joins sheet 7)
(Joins sheet 9)
(Joins sheet 13)
Asia Community
Brushy Creek
White Oak Creek
Pump Branch
Salt Creek
Paces Creek
Bear Creek
Creek
water
287
2 690 000 FEET
DkB
DbB
MoD
MoB
BoB
KM
LaB
KlB
ClB
CfB
BfB
RaD
RaB
HrB
CpC
WoD
OaB
w

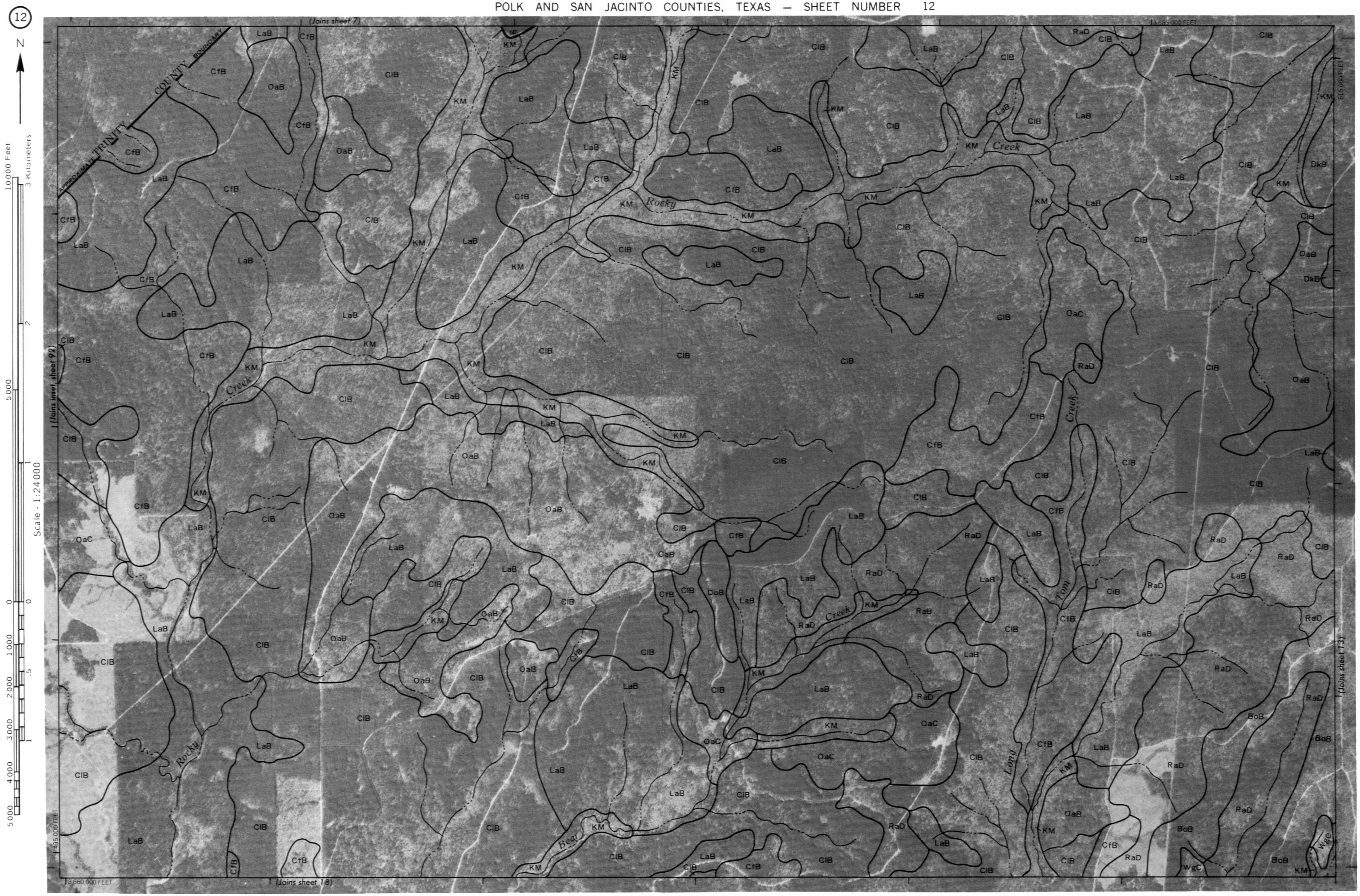

9
N
(Joins sheet 10)
(Joins sheet 8)
(Joins sheet 14)
3 720 000 FEET
3 745 000 FEET
Hightown Community
CORRIGAN
Snow Hill
Pleasant Hill
Bear Creek
Creeds Creek
McManus
Sulphur Creek
Kennedy Creek
Jones
Dry
SOUTHERN
PACIFIC
Scale - 1:24 000
10 000 Feet
3 Kilometers


N
10000 Feet
3 Kilometers
Scale - 1:24000
(Joins sheet 5)
(Joins sheet 9)
(Joins sheet 11)
(Joins sheet 15)
Pluck
Georges Prairie Pond
water
Georges
Branch
Creek
Hollow
Steep
Sulphur
Beaver
McManus
Creek
KM Creek
Sulphur
Creek
352
287
3 775 000 FEET
3 750 000 FEET
520 000 FEET

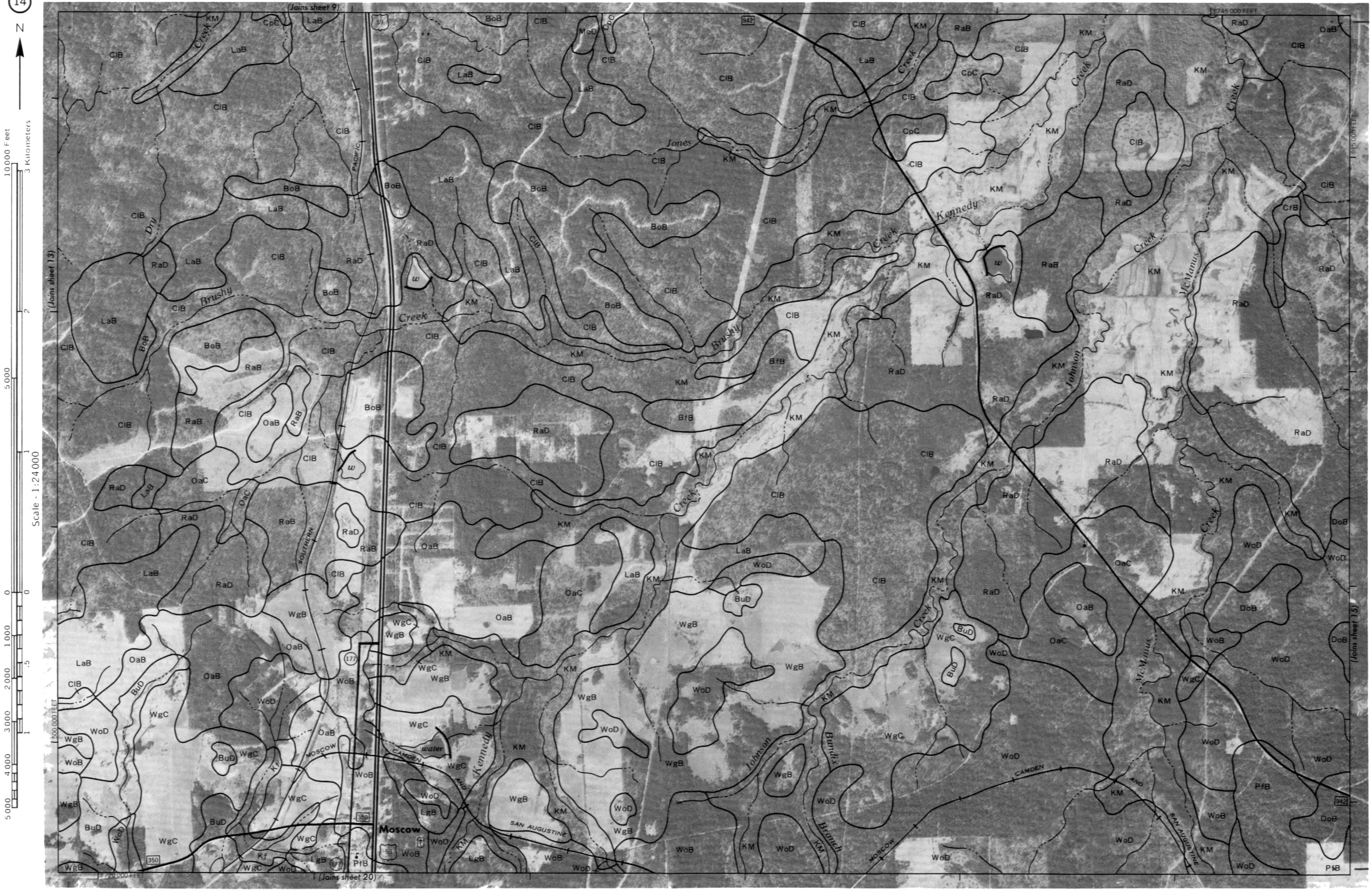

(Joins sheet 6)
3 280 000 FEET
DkB
DkB
DoB
DkB
RaD
RaD
INDEFINITE
Georges
Creek
ClB
ClB
TYLER
KM
ClB
ClB
KM
RaD
ClB
RaD
COUNTY
RaD
ClB
BOUNDARY
(Joins sheet 10)
ClB
RaD
ClB
RaD
RaD
DaC
(Joins inset, sheet 22)
3 285 000 FEET

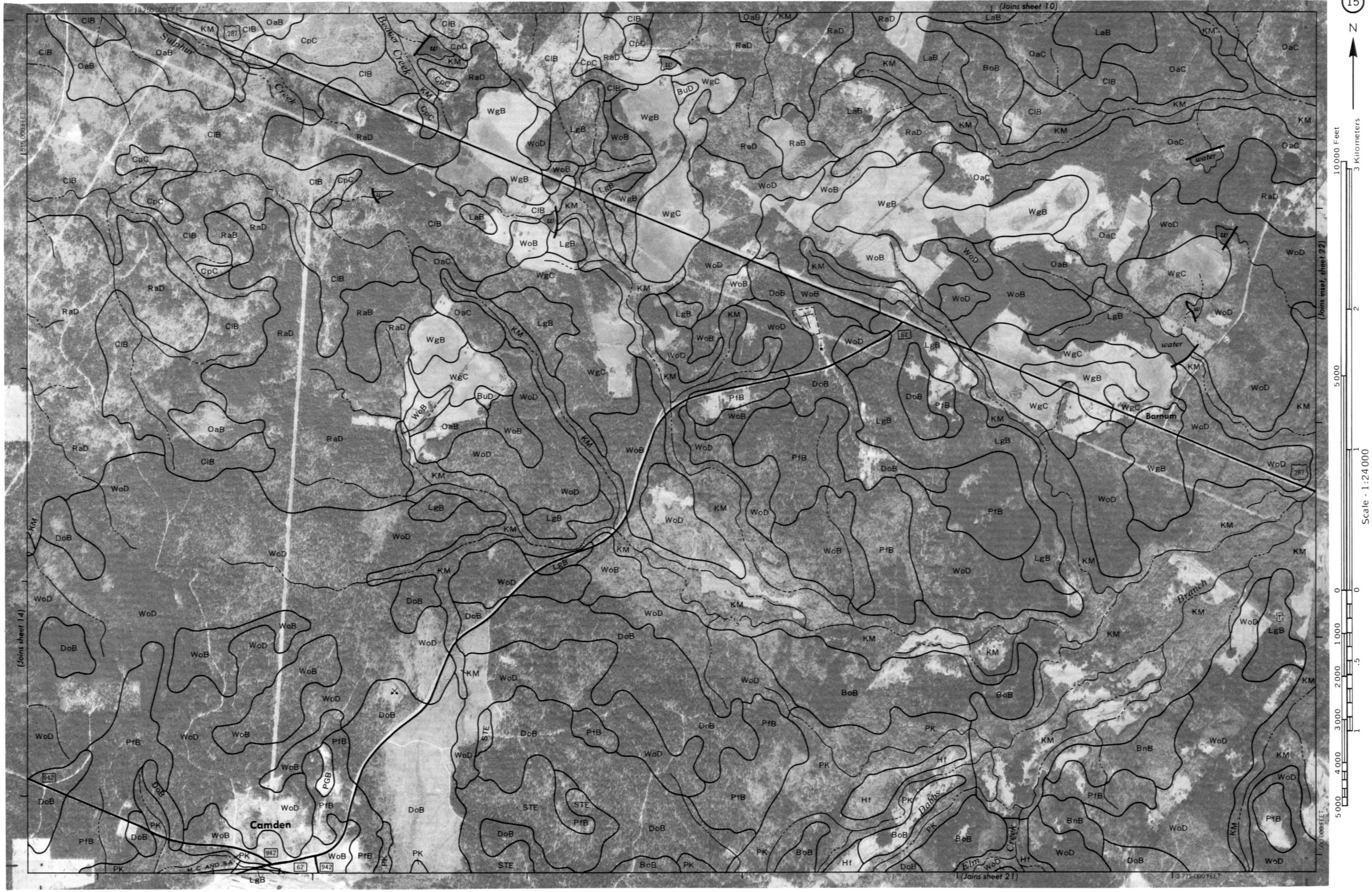

3 700 000 FEET
(Joins inset, sheet 3)
570 000 FEET
MoD
MoD
HrB
HrC
KM
MoD
MoB
HrC
DkB
HrC
BOUNDARY
HrB
MoD
357
HrC
HrB
KM
MoB
DkB
MoD
MoD
(Joins sheet 1)
MoB
COUNTY
MoB
KM
DbB
DkB
MoD
MoD
MoB
DkB
MoB
DbB
BoB
MoD
MoD
DkB
KlB
DkB
MoD
MoD
Rocky
Creek
357
DkB
TRINITY
KlB
KlB
DkB
KlB
DkB
MoD
MoD
DbB
APPROXIMATE
DbB
DkB
MoB
DkB
HrB
Upper
DkB
HrB
MoB
DkB
Sulphur
MoB
MoD
DkB
Creek
MoB
MoD
DkB
DkB
DkB
DkB
MoB
DkB
(Joins sheet 3)
3 715 000 FEET

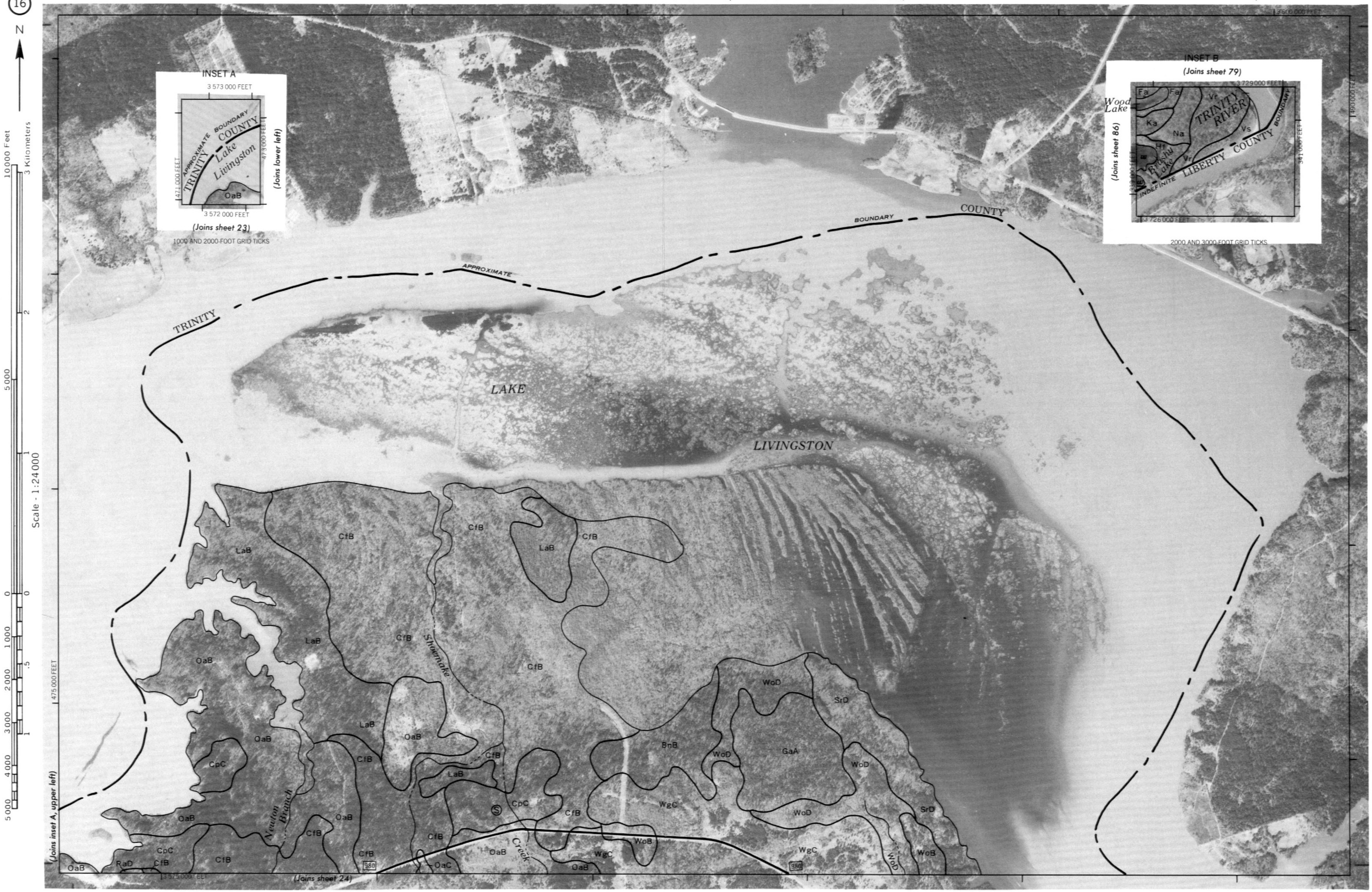

11
N
10000 Feet
3 Kilometers
5 000
2
1
Scale - 1:24000
0
1000
2000
3000
4000
5000
.5
1

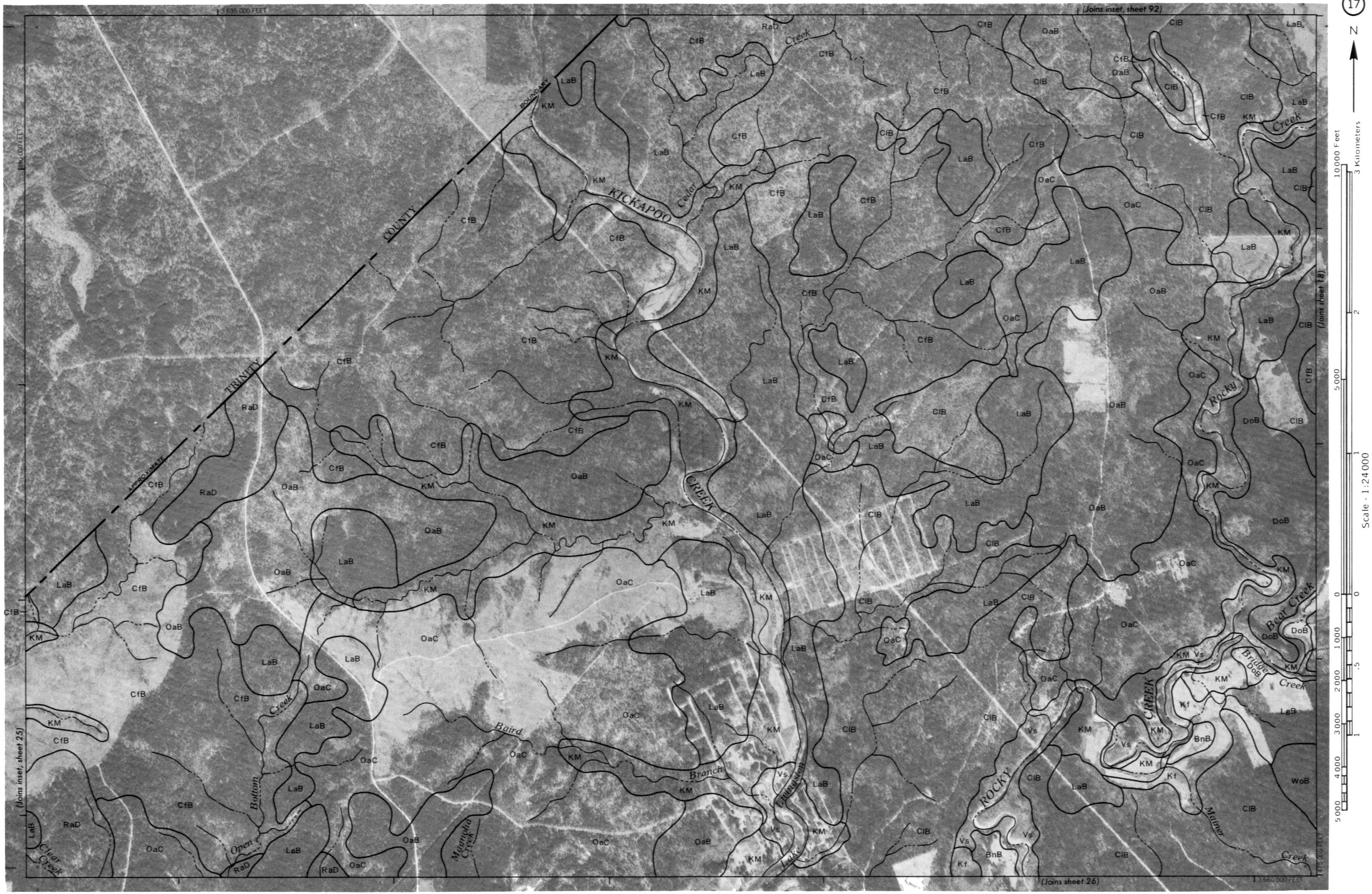

12
N
(Joins sheet 7)
(Joins sheet 18)
(Joins sheet 13)
(Joins inset, sheet 92)
APPROXIMATE TRINITY COUNTY BOUNDARY
Rocky Creek
Long Tom Creek
Bear
Scale 1:24000
10 000 Feet
3 Kilometers
3 660 000 FEET
3 685 000 FEET
495 000 FEET
615 000 FEET
CfB
ClB
LaB
OaB
OaC
KM
RaD
DoB
DkB
BoB
WgC

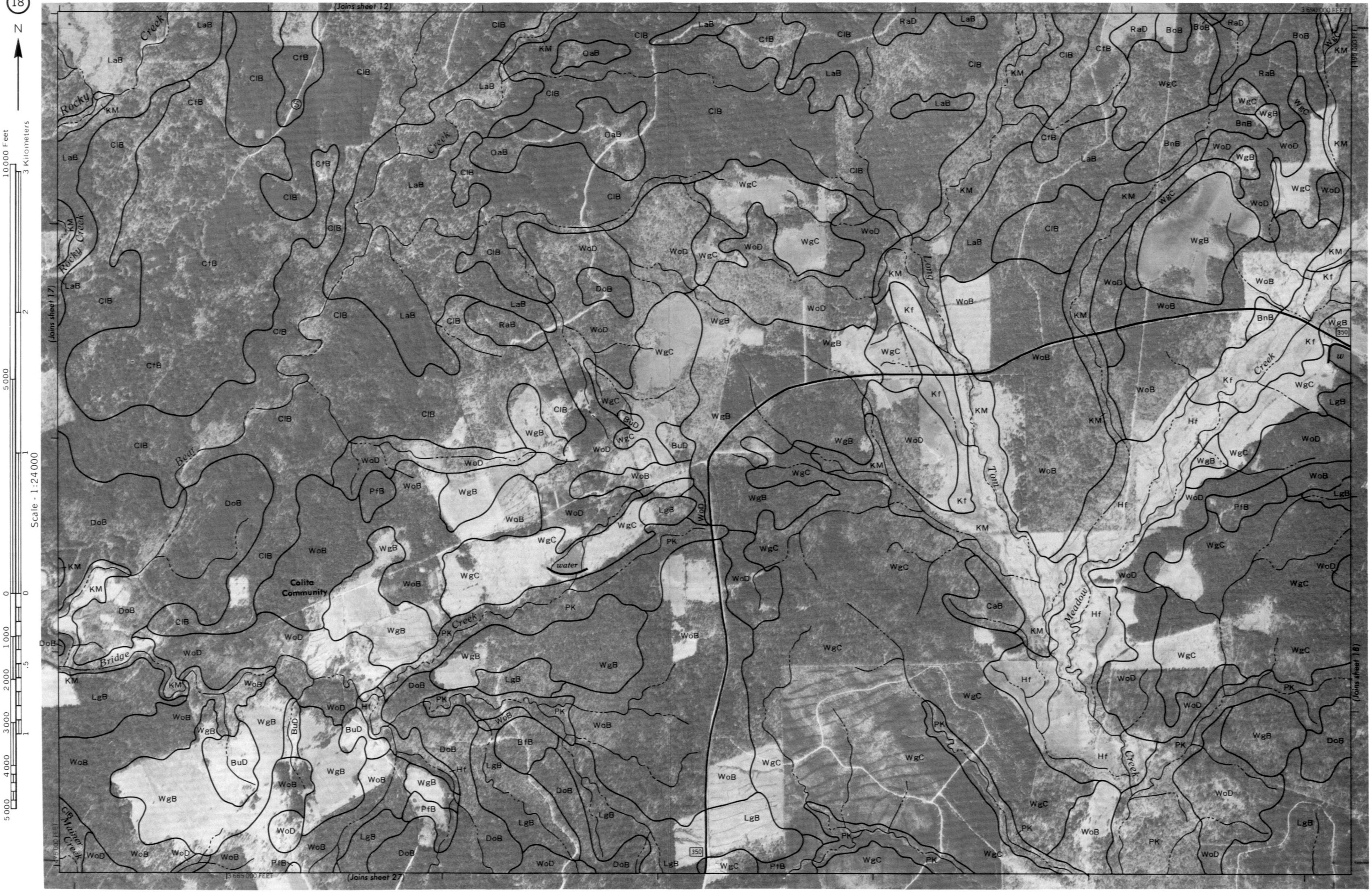

13
N
(Joins sheet 8)
(Joins sheet 14)
(Joins sheet 19)
(Joins sheet 12)
3 690 000 FEET
3 715 000 FEET
500 000 FEET
White
Oak
Creek
Salt
Creek
Paces
Creek
Bear
Barnett
Creek
Meadow
Creek
Long
King
Creek
water
350
1 Mile
5000
4000
3000
2000
1000
0
5000
10 000 Feet
3 Kilometers
Scale - 1:24 000

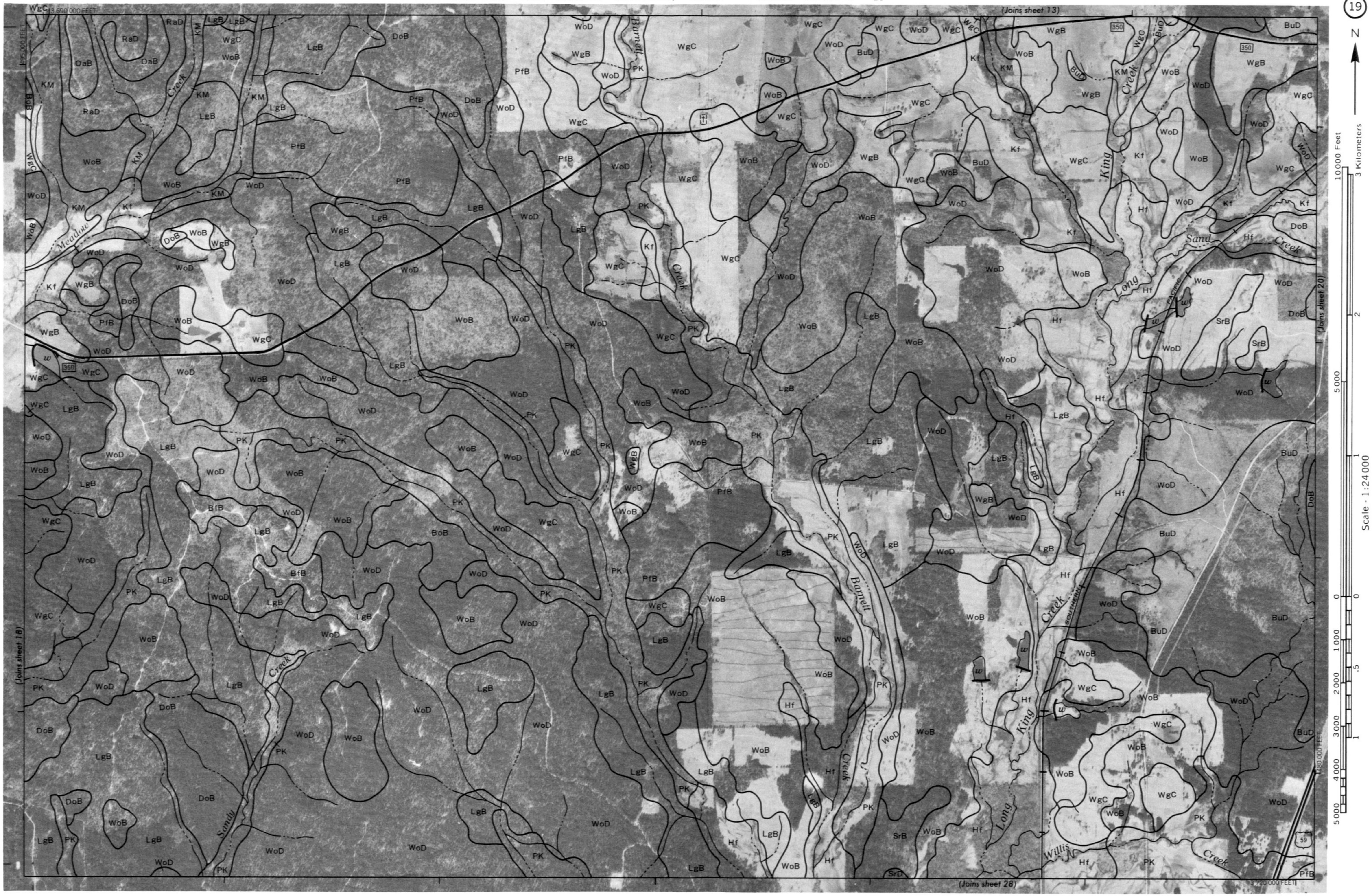

N
10000 Feet
3 Kilometers
Scale - 1:24 000
(Joins sheet 9)
(Joins sheet 13)
(Joins sheet 15)
(Joins sheet 20)
3 745 000 FEET
Dry Creek
Brushy Creek
Jones Creek
Kennedy Creek
Johnson Creek
McManus Creek
Bundick Branch
PACIFIC
SOUTHERN
MOSCOW
CAMDEN AND SAN AUGUSTINE
water
Moscow


(Joins sheet 10)
(Joins sheet 14)
(Joins inset, sheet 22)
(Joins sheet 21)
Sulphur Creek
Beaver Creek
Barnum
Camden
Branch
Dabbs
Elm Creek
M. C. AND S.A.
water
N
10000 Feet
5000
0
1000
2000
3000
4000
5000
3 Kilometers
2
1
.5
0
1
Scale - 1:24 000

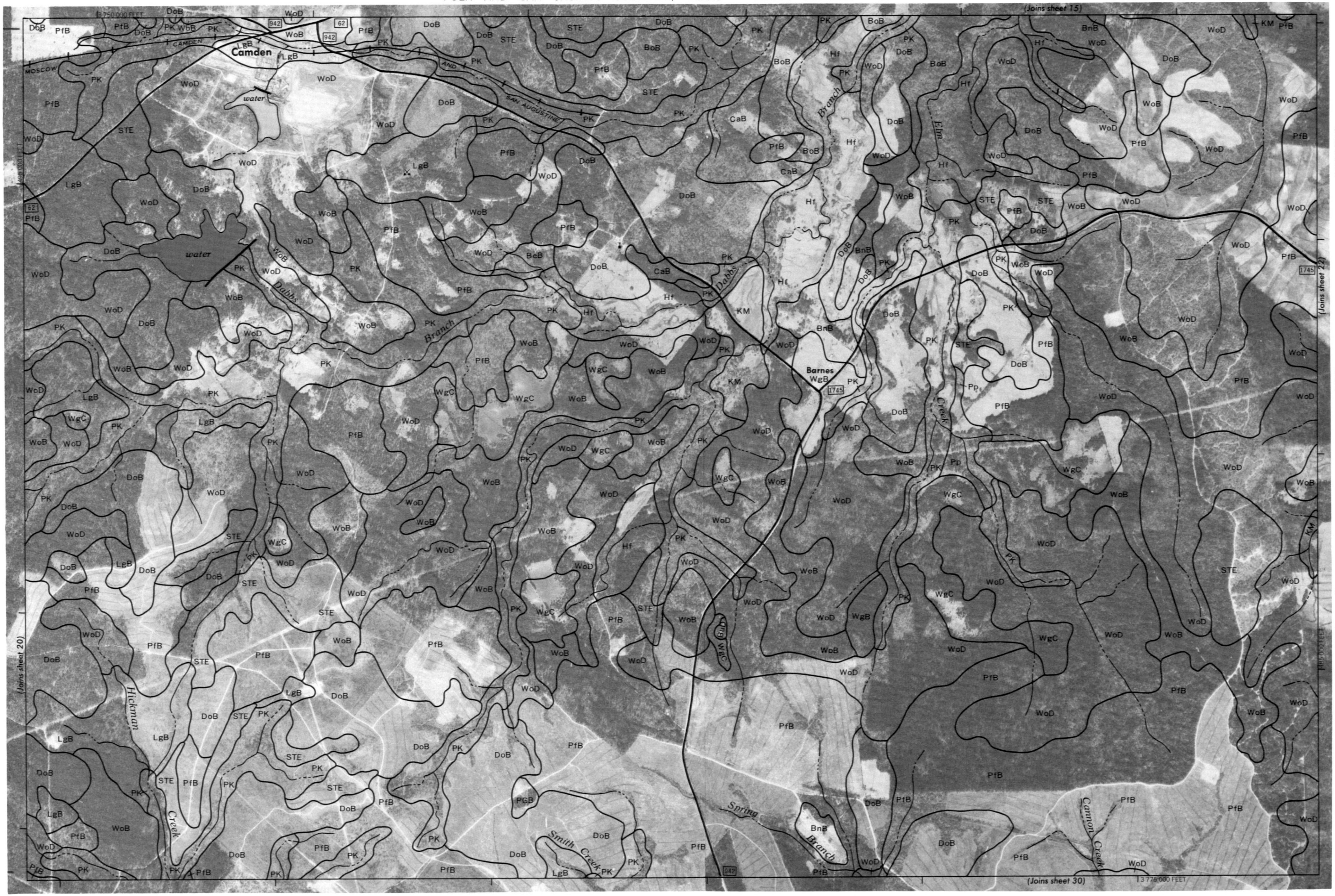

16
N
Scale - 1:24000
10 000 Feet
5 000
0
1000
2000
3000
4000
5000
3 Kilometers
2
1
0
.5
1
INSET A
3 573 000 FEET
APPROXIMATE BOUNDARY
TRINITY COUNTY
Lake Livingston
OaB
471 000 FEET
473 000 FEET
3 572 000 FEET
(Joins sheet 23)
(Joins lower left)
1000 AND 2000-FOOT GRID TICKS
INSET B
(Joins sheet 79)
3 729 000 FEET
Wood Lake
Fa
Fe
Ka
Na
Ht
Vr
Vs
TRINITY RIVER
Brushy Lake
INDEFINITE
LIBERTY COUNTY BOUNDARY
(Joins sheet 86)
341 000 FEET
3 726 000 FEET
2000 AND 3000-FOOT GRID TICKS
TRINITY
APPROXIMATE
BOUNDARY
COUNTY
LAKE
LIVINGSTON
LaB
CfB
OaB
CpC
Newton Branch
Shoemake
Creek
BnB
WoD
SrD
GaA
WgC
WoB
CpC
OaC
RaD
380
475 000 FEET
3 575 000 FEET
(Joins sheet 24)
(Joins inset A, upper left)
3 600 000 FEET


17
N
(Joins inset, sheet 92)
(Joins sheet 18)
(Joins sheet 26)
(Joins inset, sheet 25)
TRINITY COUNTY BOUNDARY
APPROXIMATE
KICKAPOO CREEK
Cedar Creek
Rocky Creek
Bear Creek
Bridge Creek
Baird Branch
Bottom Creek
Open
Clear Creek
Magnolia Creek
Lake Livingston
ROCKY CREEK
Mainer Creek
10 000 Feet
3 Kilometers
Scale - 1:24 000


N
10000 Feet
3 Kilometers
Scale - 1:24000
(Joins sheet 12)
(Joins sheet 17)
(Joins sheet 27)
Rocky Creek
Bear Creek
Bridge Creek
Long Tom Creek
Meadow Creek
Colita Community
water
350


(Joins sheet 13)
(Joins sheet 18)
(Joins sheet 20)
(Joins sheet 28)
N
Scale - 1:24000
10 000 Feet
5 000
0
1000
2000
3000
4000
5000
3 Kilometers
2
1
0
.5
1
Meadow
Creek
Barnett
Creek
King
Creek
Long
Sand
Creek
Sandy
Creek
Willis
Creek
350
59


20
N
(Joins sheet 14)
Moscow
MOSCOW
CAMDEN AND SAN AUGUSTINE
SOUTHERN PACIFIC
Kennedy Creek
Johnson Creek
Creek
Bundix
McManus Creek
Sand Creek
Willis Creek
(Joins sheet 19)
(Joins sheet 21)
(Joins sheet 29)
3 720 000 FEET
3 745 000 FEET
10 000 Feet
3 Kilometers
Scale - 1:24 000
5000
0
1000
2000
3000
4000
5000
2
1
.5



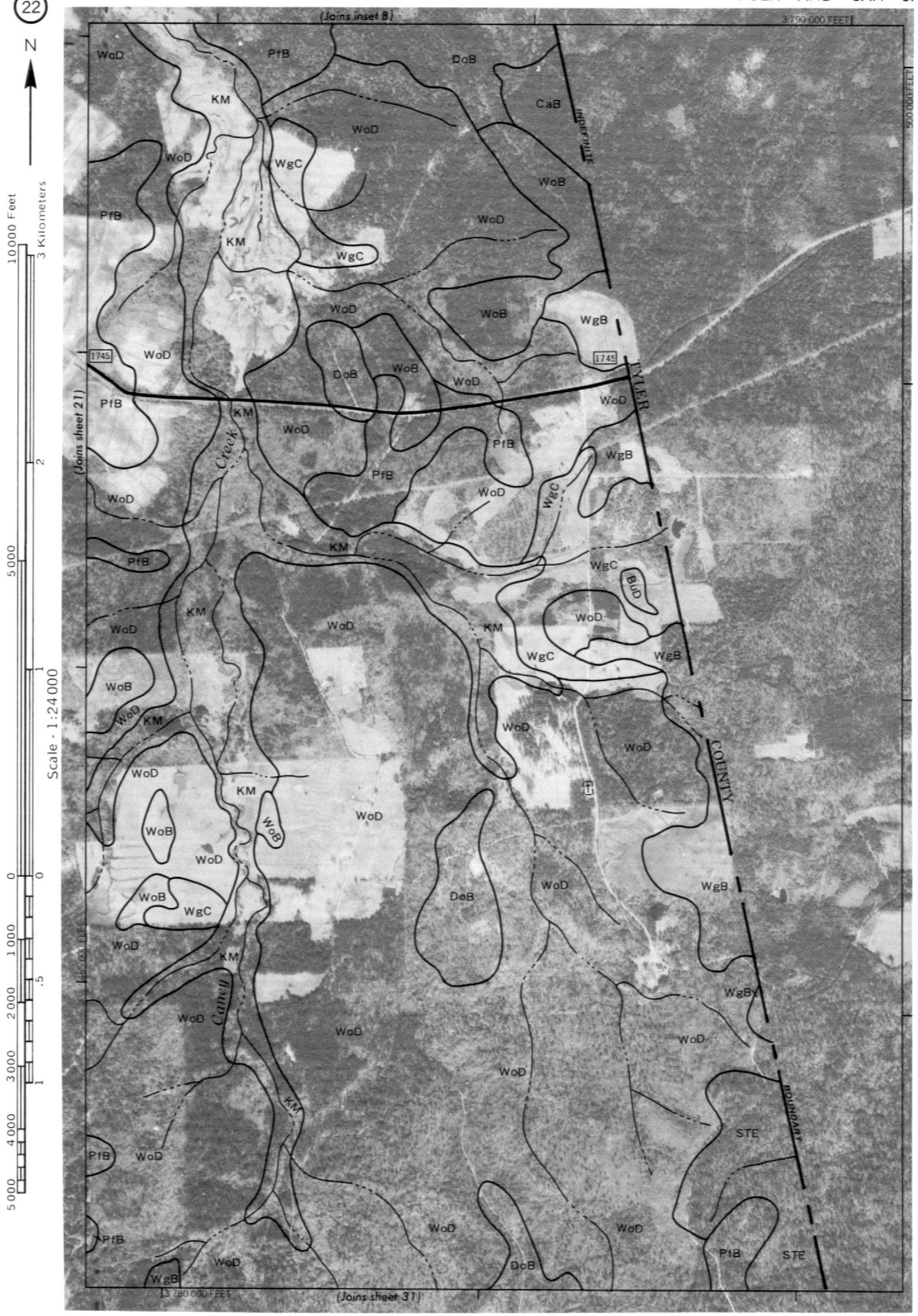
21

N

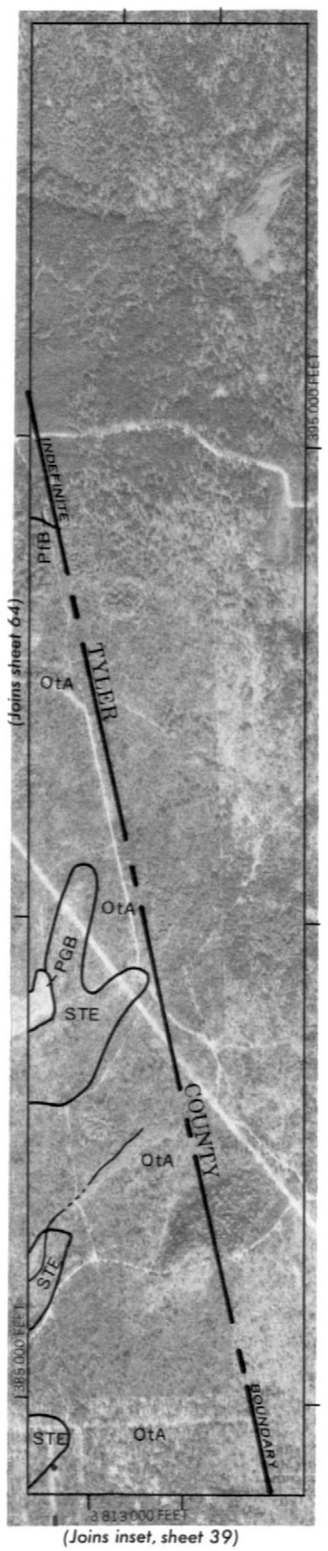
10000 Feet

3 Kilometers

Scale - 1:24000



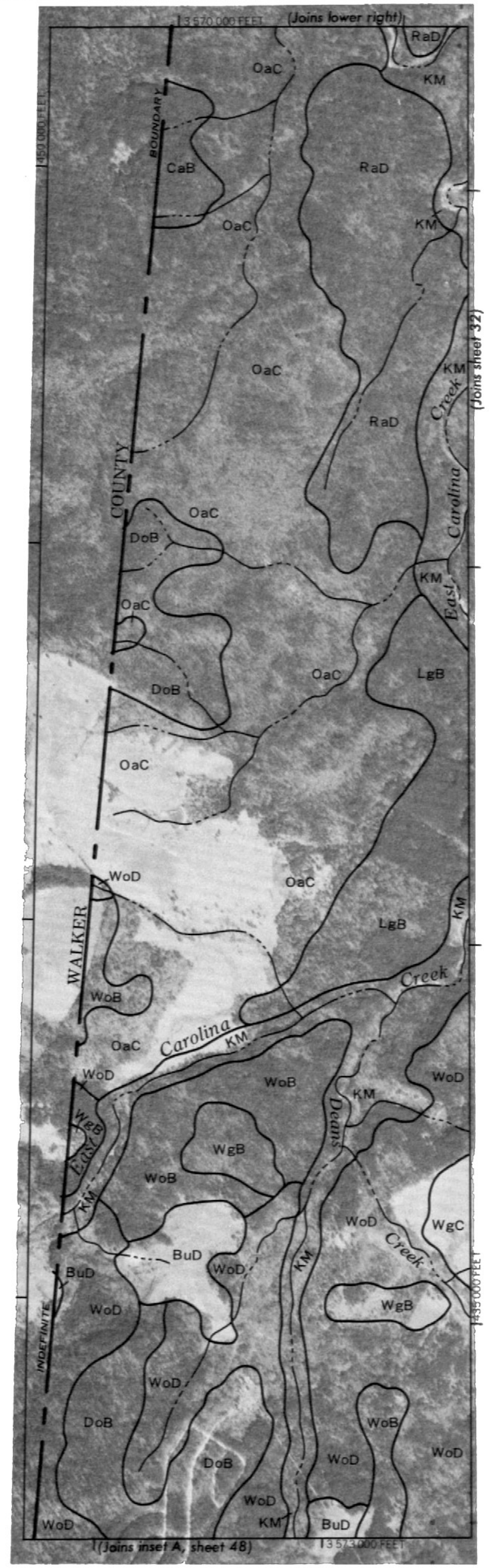
INSET A

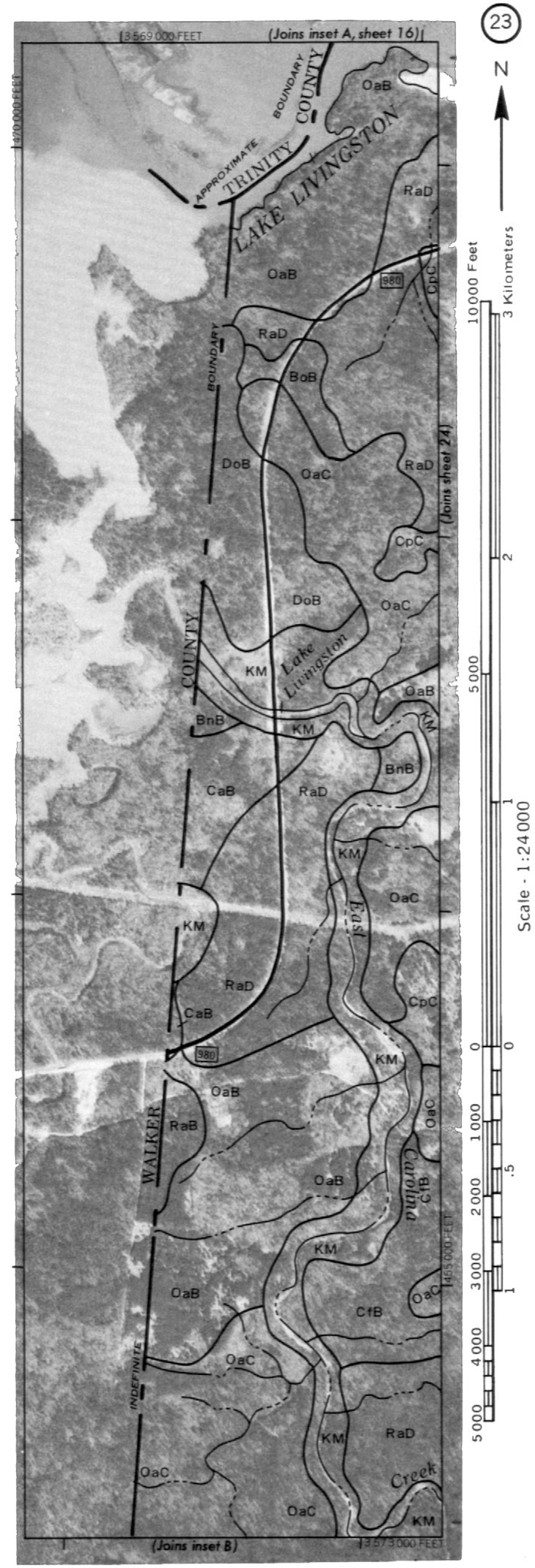


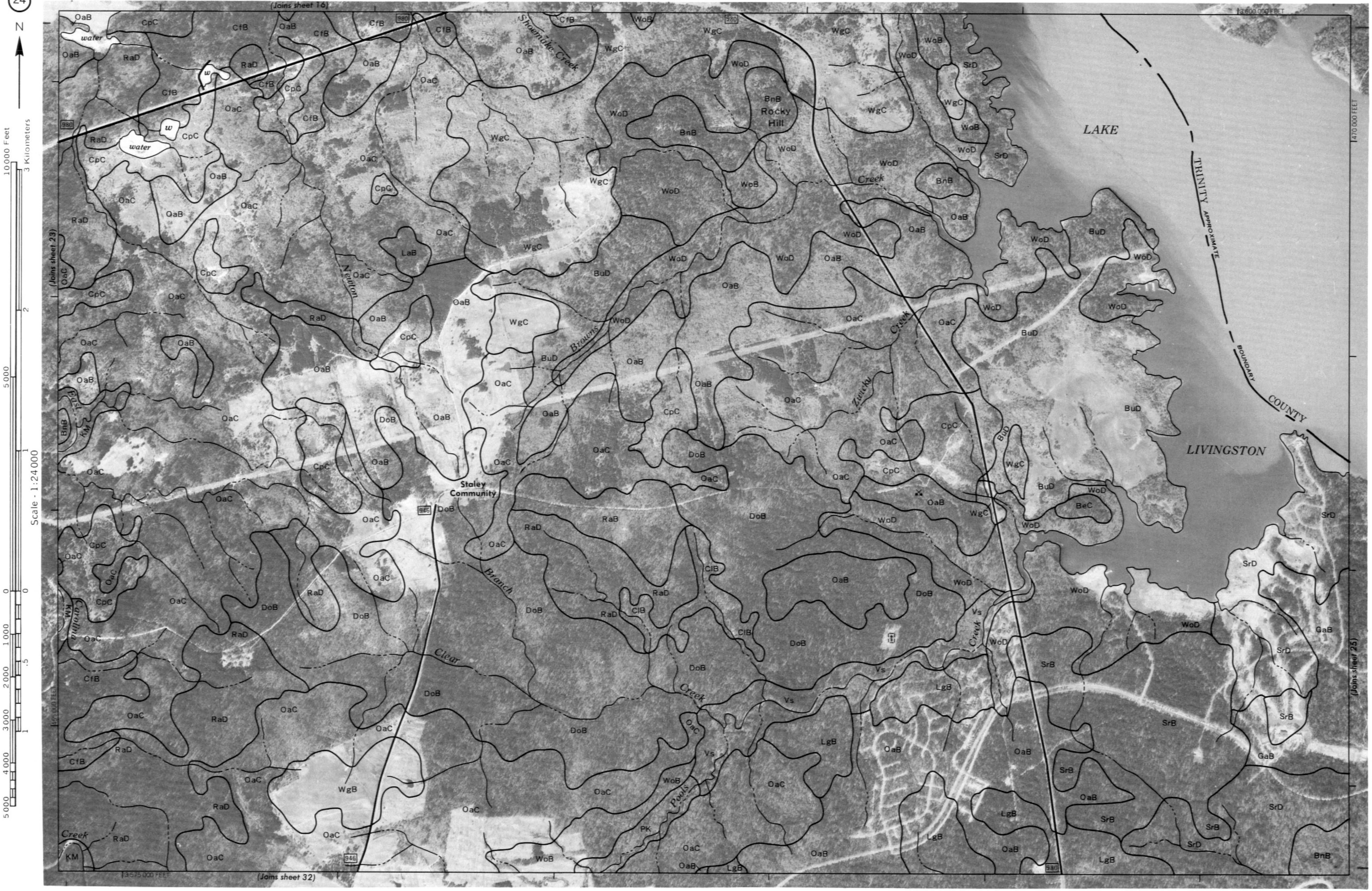
INSET B

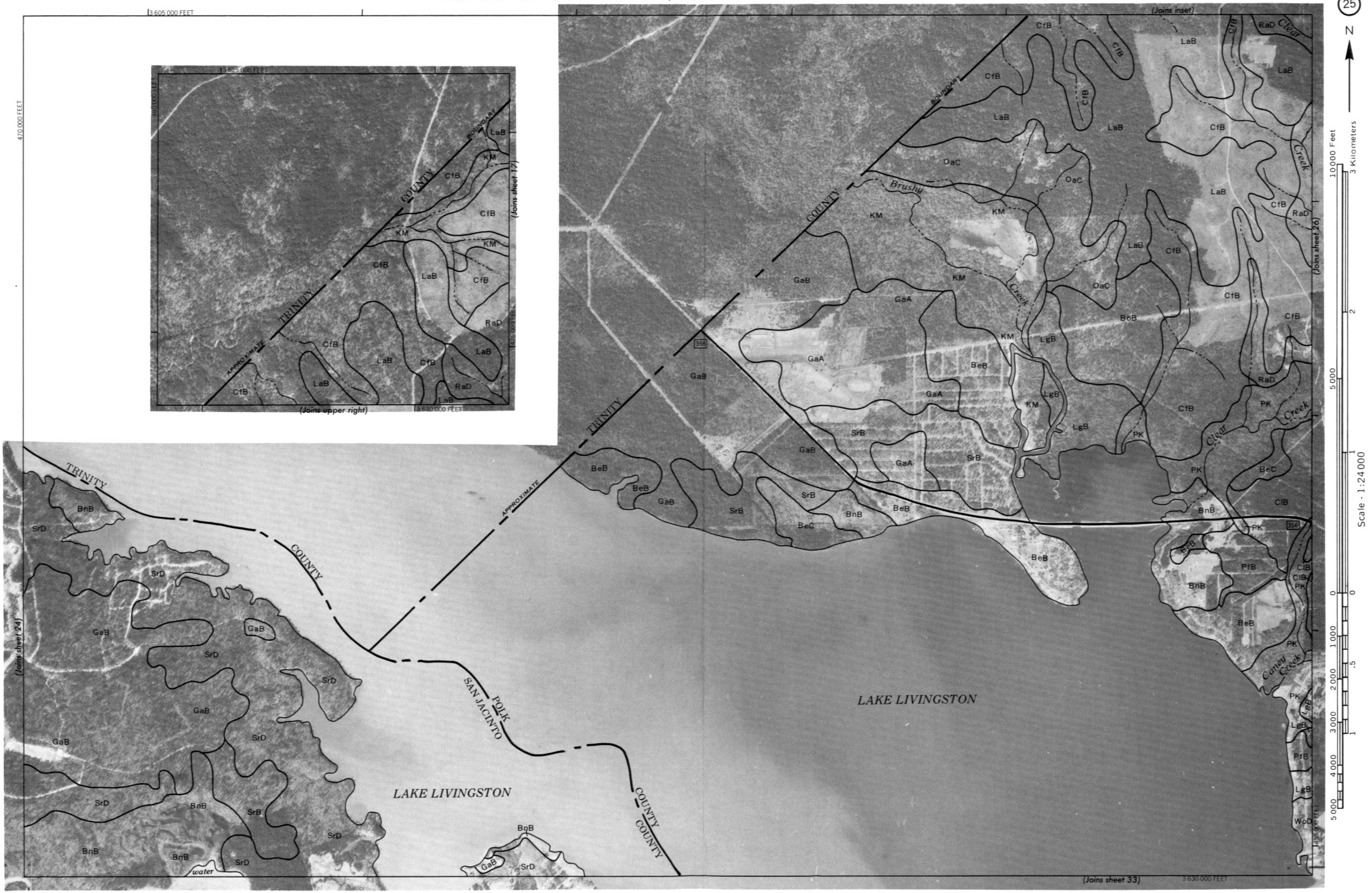
INSET A

INSET B

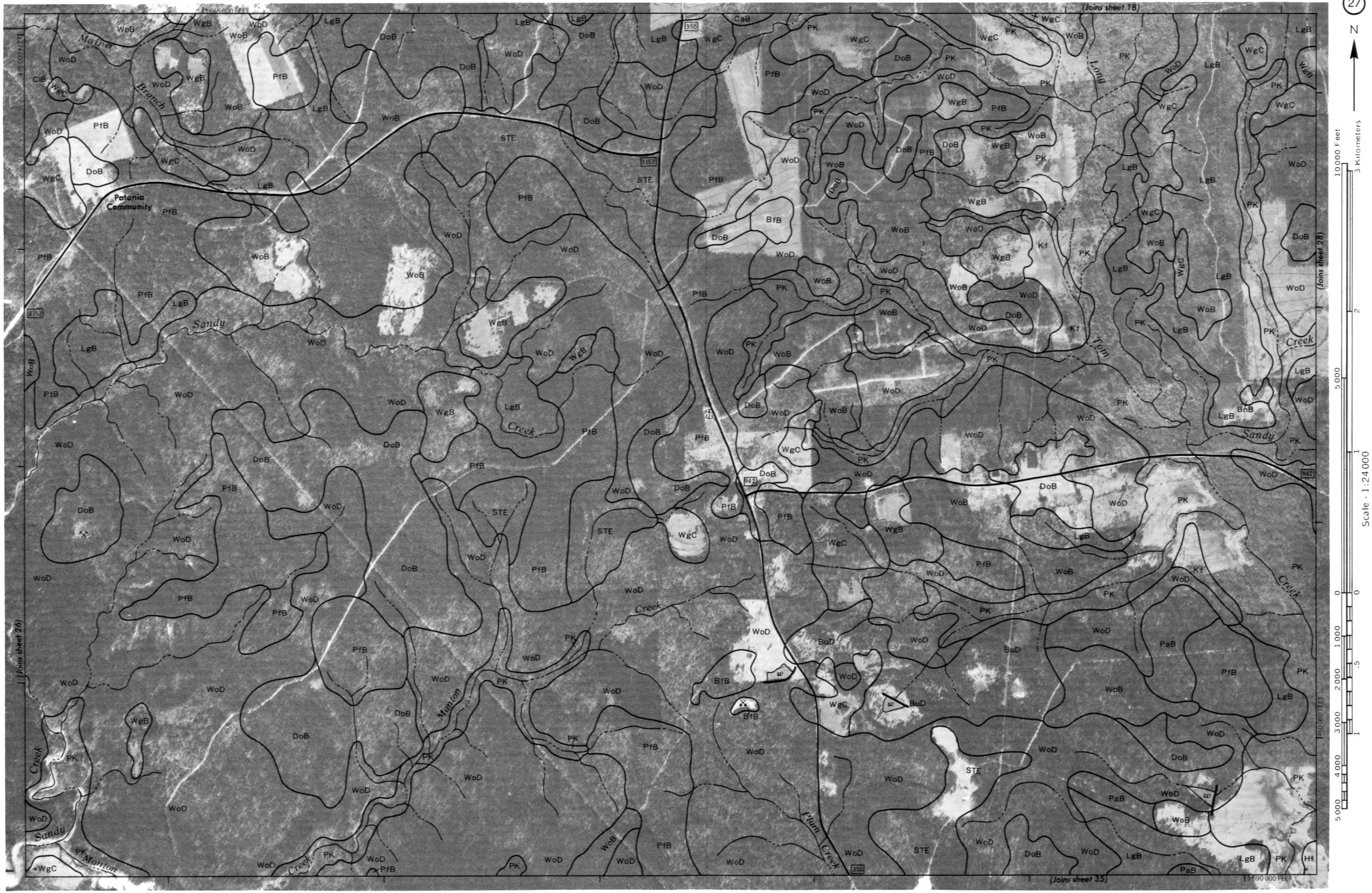


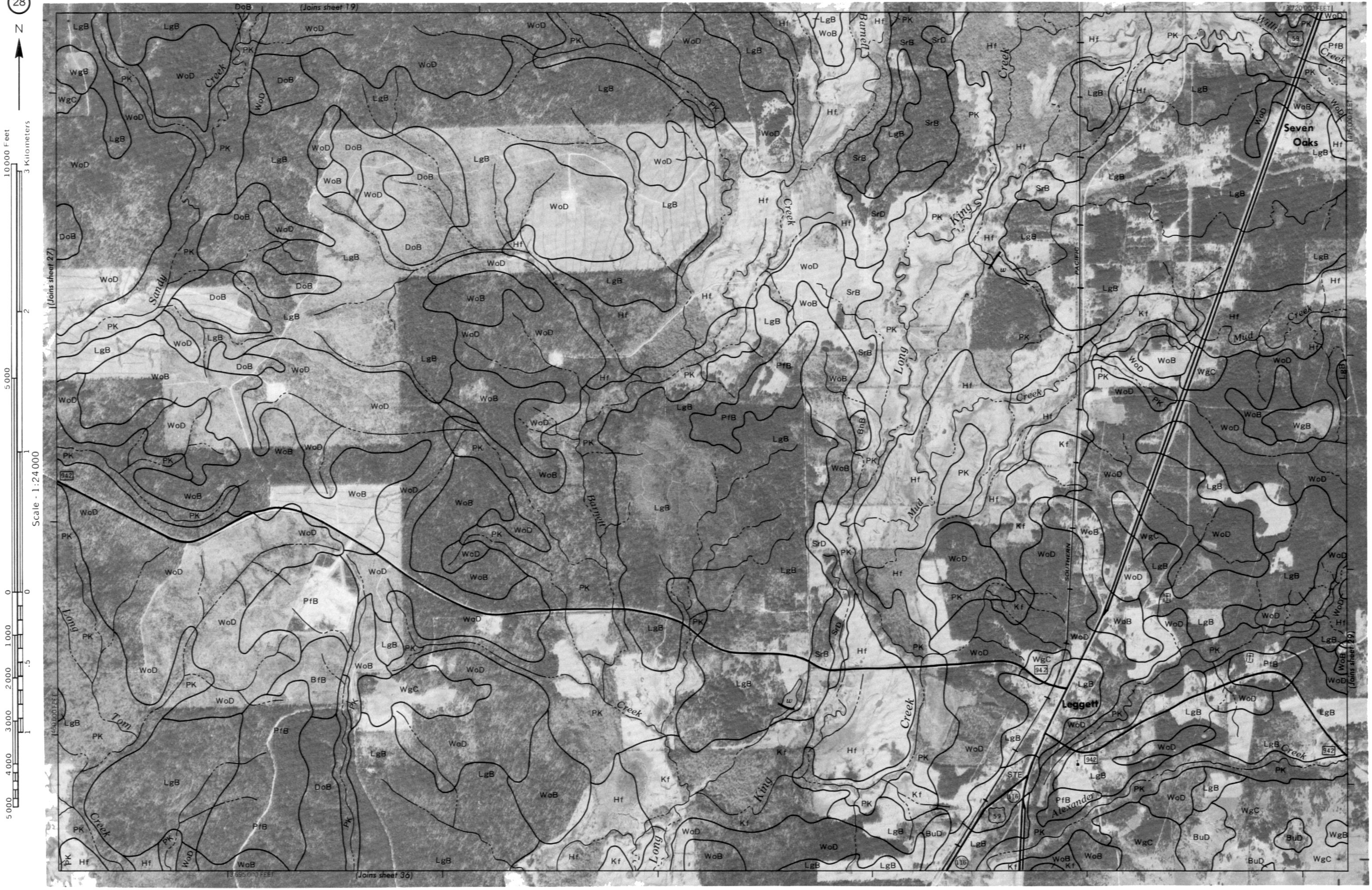


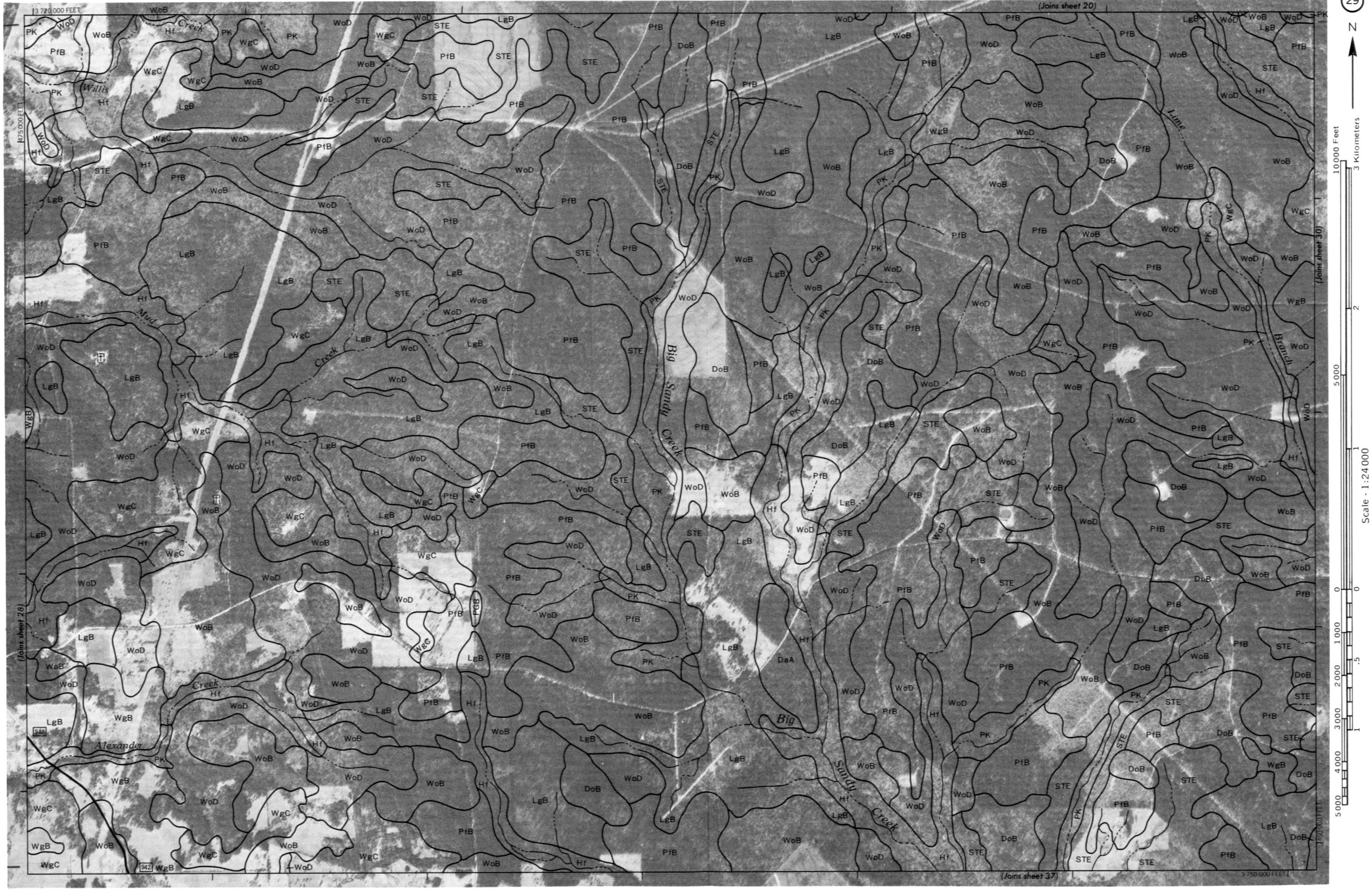

N
10 000 Feet
3 Kilometers
Scale 1:24 000
(Joins sheet 16)
(Joins sheet 23)
(Joins sheet 25)
(Joins sheet 32)
3 600 000 FEET
470 000 FEET
3 575 000 FEET
LAKE
LIVINGSTON
TRINITY
APPROXIMATE
BOUNDARY
COUNTY
Rocky Hill
Staley Community
Shoemake Creek
Newton
Browns
Creek
Zuricky
Clear
Branch
Pools
Carolina
water
980
946

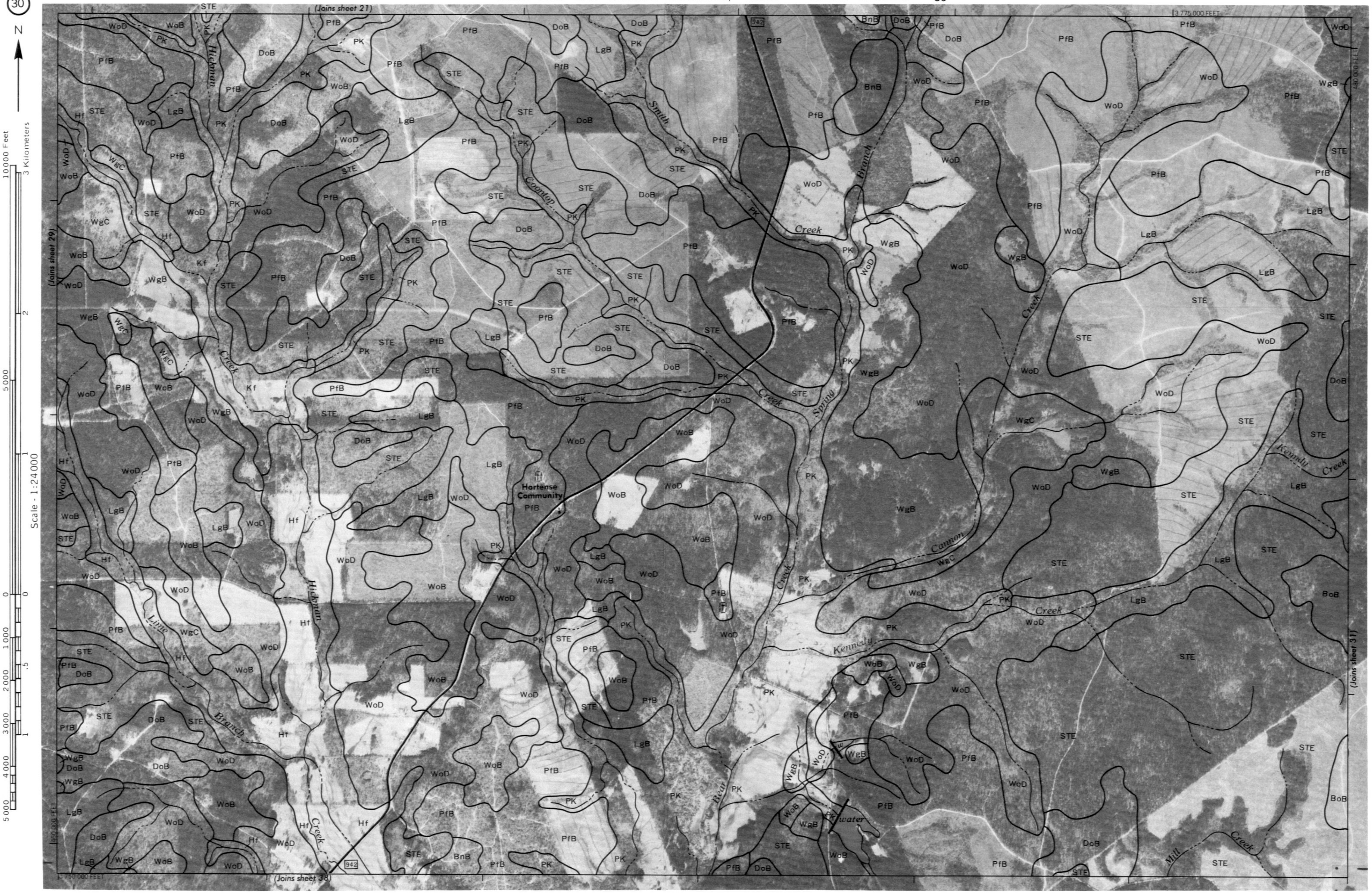

25
N
10000 Feet
3 Kilometers
Scale - 1:24000
LAKE LIVINGSTON
LAKE LIVINGSTON
TRINITY COUNTY
POLK COUNTY
SAN JACINTO COUNTY
APPROXIMATE TRINITY COUNTY BOUNDARY
Brushy Creek
Clear Creek
Caney Creek
(Joins inset)
(Joins sheet 26)
(Joins sheet 33)
(Joins sheet 24)
(Joins sheet 17)
(Joins upper right)
356
water

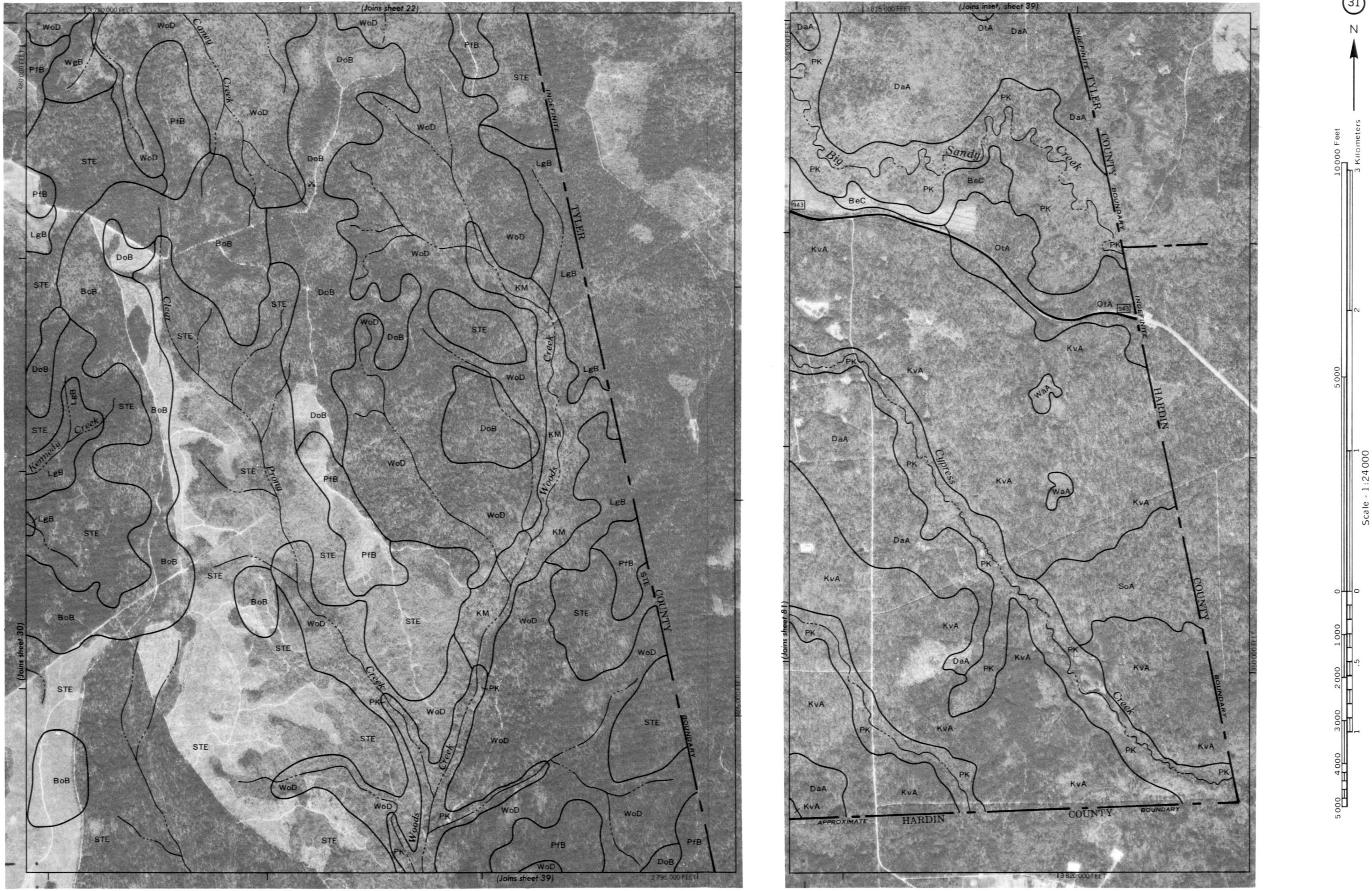

N
Scale - 1:24 000
10000 Feet
3 Kilometers
(Joins sheet 17)
(Joins sheet 25)
(Joins sheet 27)
(Joins sheet 34)
Magnolia Community
Magnolia Creek
Open Bottom Creek
Clear Creek
Caney Creek
Creek
Rocky Creek
Bear Creek
Manning Branch
Mainer Branch
Sank Branch
Robinett Branch
Crawford Lake
water
Sandy Creek
LAKE LIVINGSTON
Lake Livingston
356
190
3186
3152

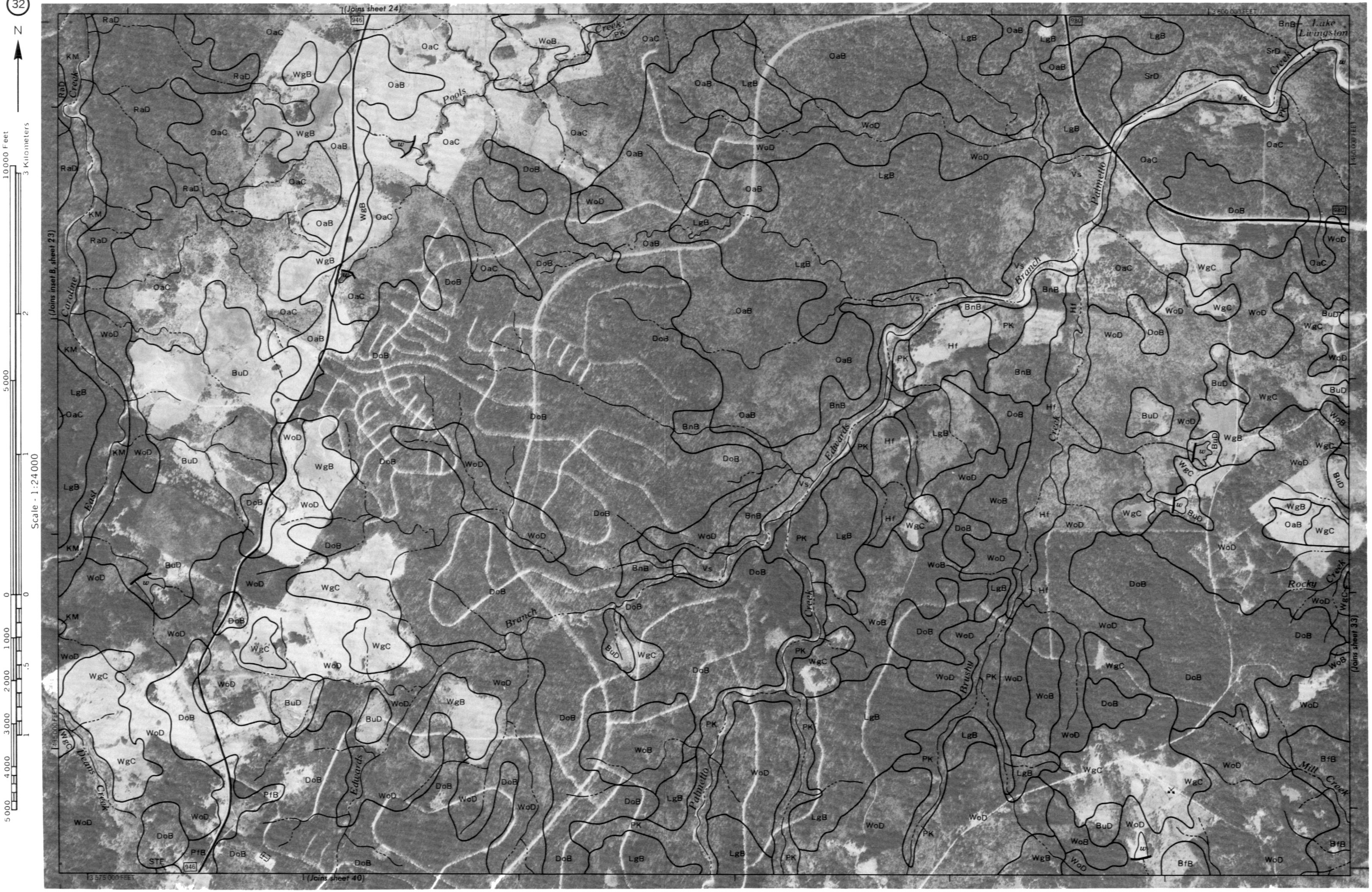

27
N
(Joins sheet 18)
(Joins sheet 28)
(Joins sheet 35)
(Joins sheet 26)
Patonic Community
Mainer Branch
Sandy Creek
Long Tom Creek
Manton Creek
Plum Creek
Scale - 1:24 000
10 000 Feet
3 Kilometers
3 655 000 FEET
3 690 000 FEET
350
942
3152


28
N
Scale - 1:24000
10000 Feet
3 Kilometers
(Joins sheet 19)
(Joins sheet 27)
(Joins sheet 29)
(Joins sheet 36)
Seven Oaks
Leggett
Sandy Creek
Barnett Creek
Long King Creek
Mud Creek
Long Tom Creek
Alexander Creek
Willis Creek
Southern Pacific
942
59
146
STE

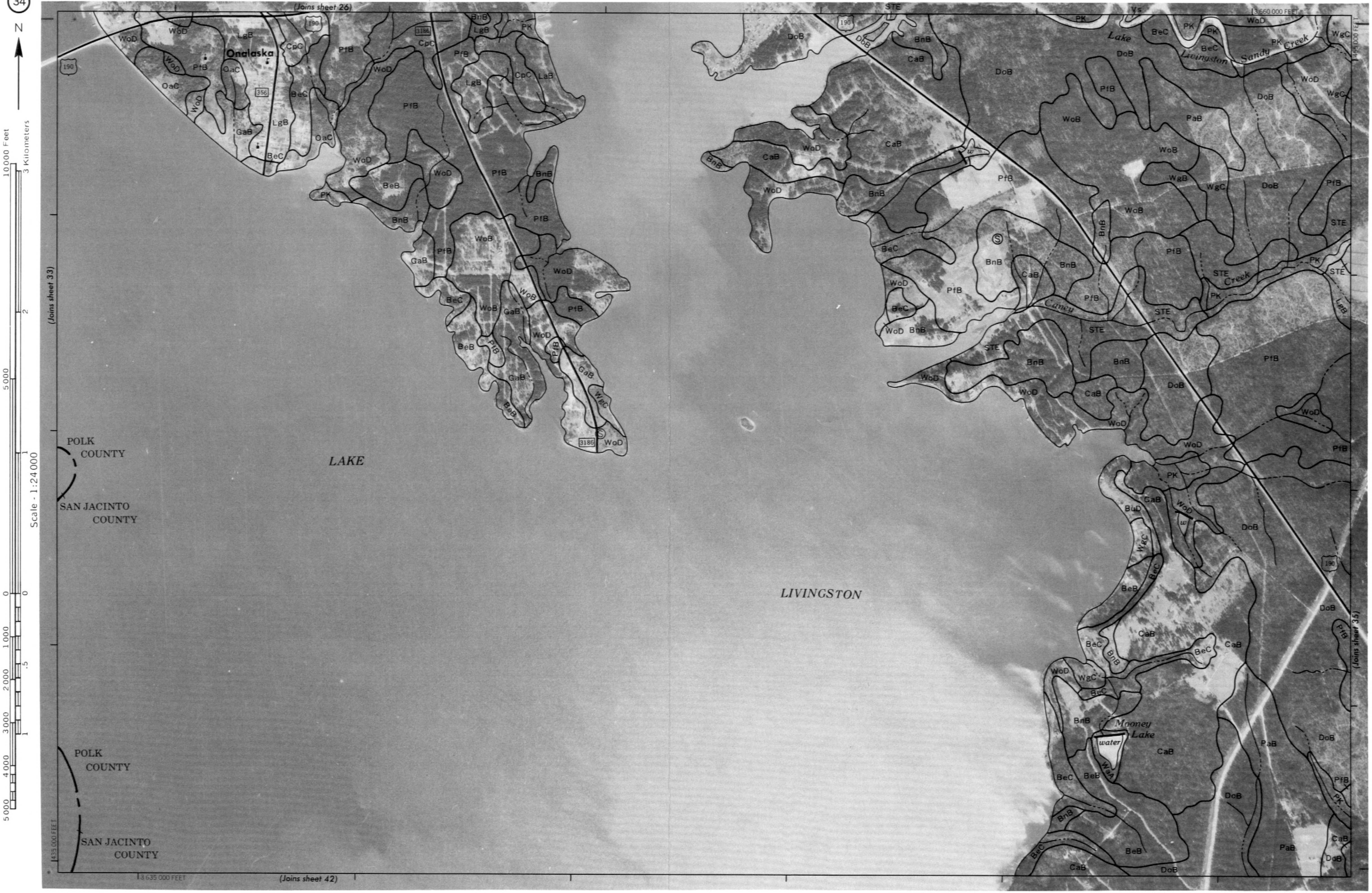

29
N
(Joins sheet 20)
(Joins sheet 30)
(Joins sheet 37)
(Joins sheet 28)
Willis Creek
Mud Creek
Big Sandy Creek
Lime Branch
Alexander Creek
942
10000 Feet
3 Kilometers
Scale - 1:24 000

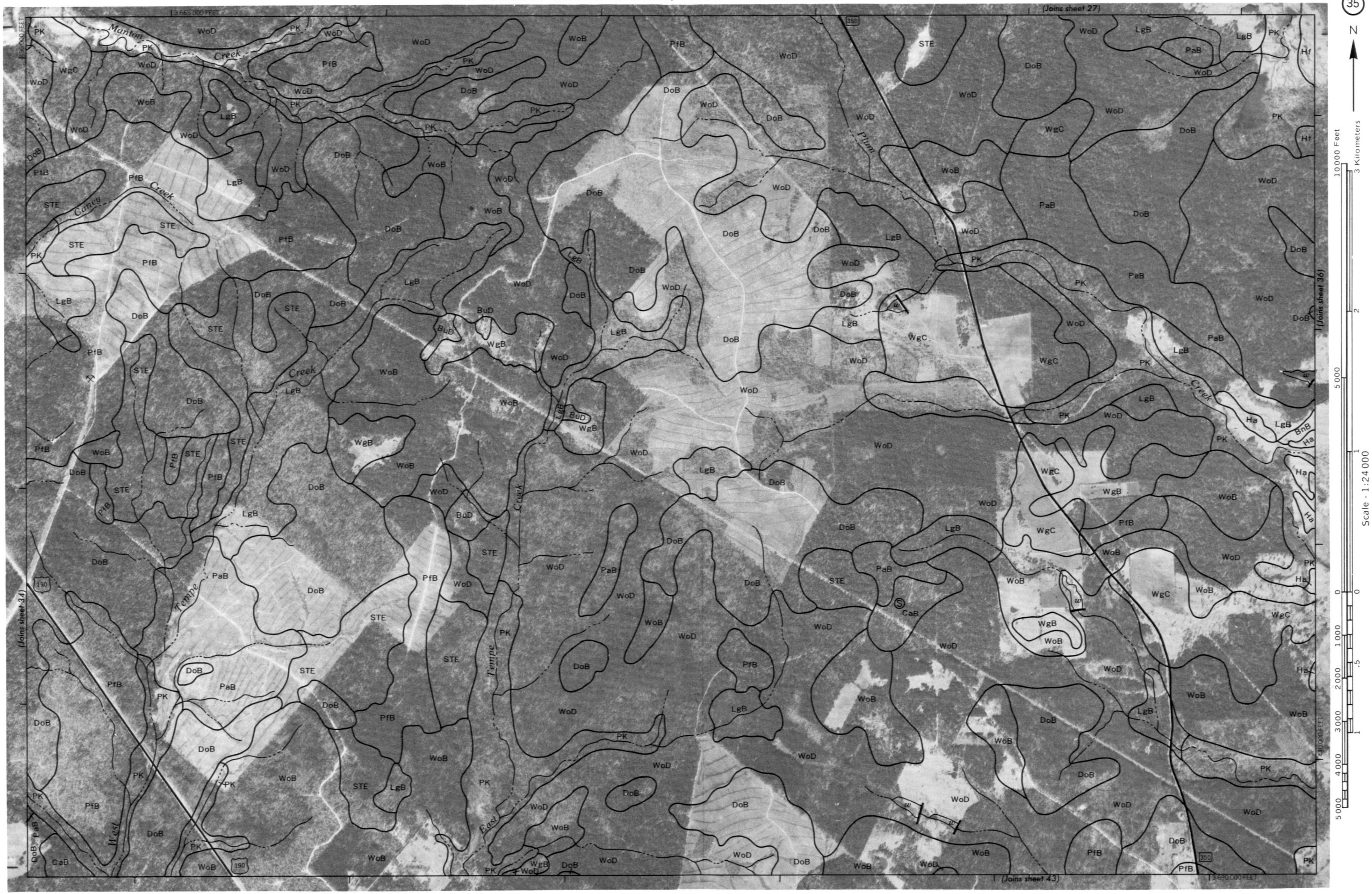

N
(Joins sheet 21)
(Joins sheet 29)
(Joins sheet 31)
(Joins sheet 38)
Hortense Community
Hickman Creek
Coontop Creek
Smith Creek
Branch
Spring Creek
Kennedy Creek
Cannon Creek
Lime Branch
Bear Creek
Mill Creek
water
942
3 775 000 FEET
3 750 000 FEET
Scale - 1:24000
10 000 Feet
5000
0
1000
2000
3000
4000
5000
3 Kilometers
2
1
.5
0

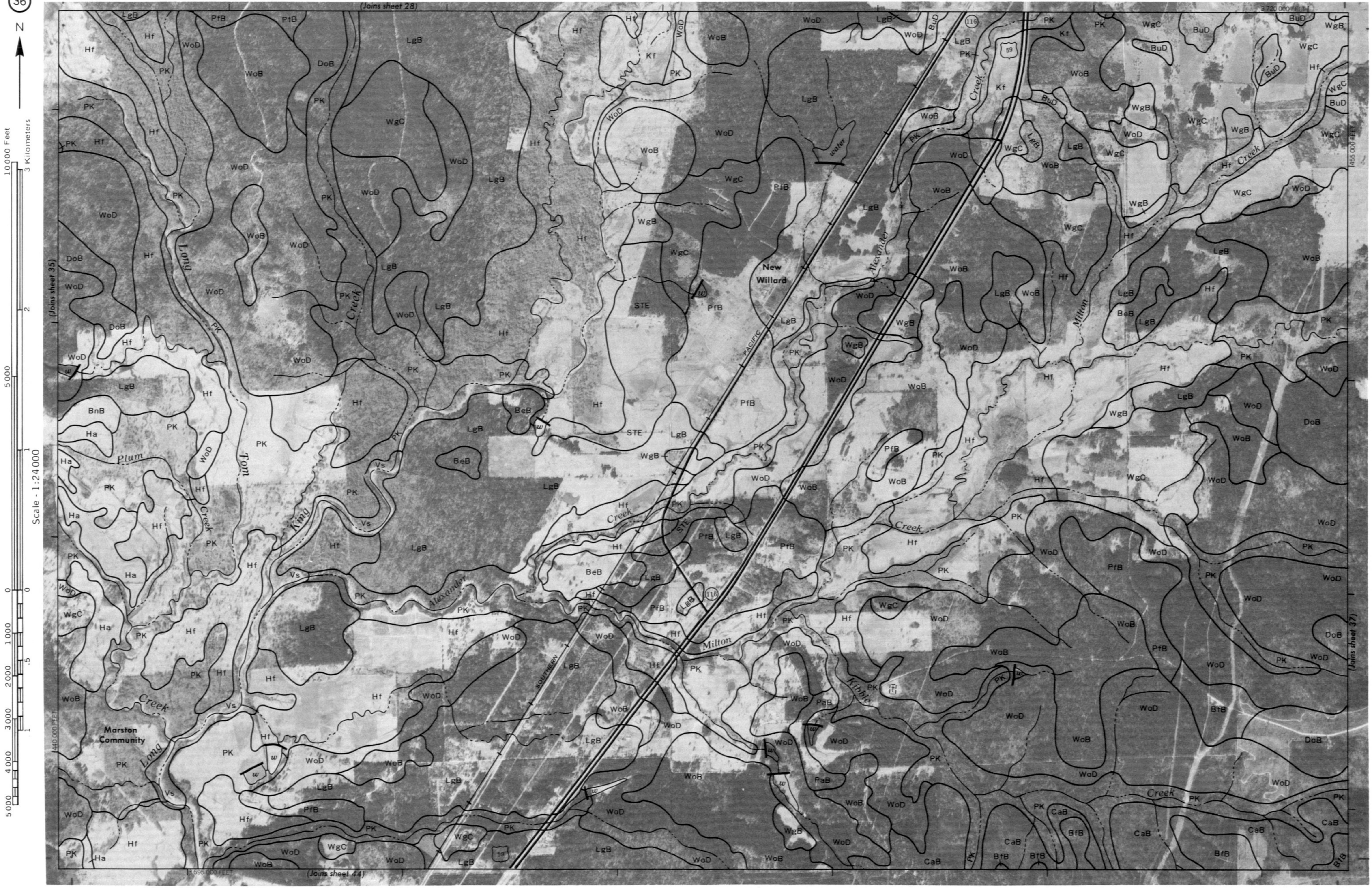

(Joins sheet 22)
(Joins inset, sheet 39)
(Joins sheet 39)
(Joins sheet 30)
(Joins sheet 81)
3 780 000 FEET
3 795 000 FEET
3 815 000 FEET
3 820 000 FEET
INDEFINITE TYLER COUNTY BOUNDARY
INDEFINITE HARDIN COUNTY BOUNDARY
APPROXIMATE HARDIN COUNTY BOUNDARY
Caney Creek
Clear Prong
Kennedy Creek
Woods Creek
Big Sandy Creek
Cypress Creek
943
31
N
10000 Feet
3 Kilometers
Scale - 1:24 000

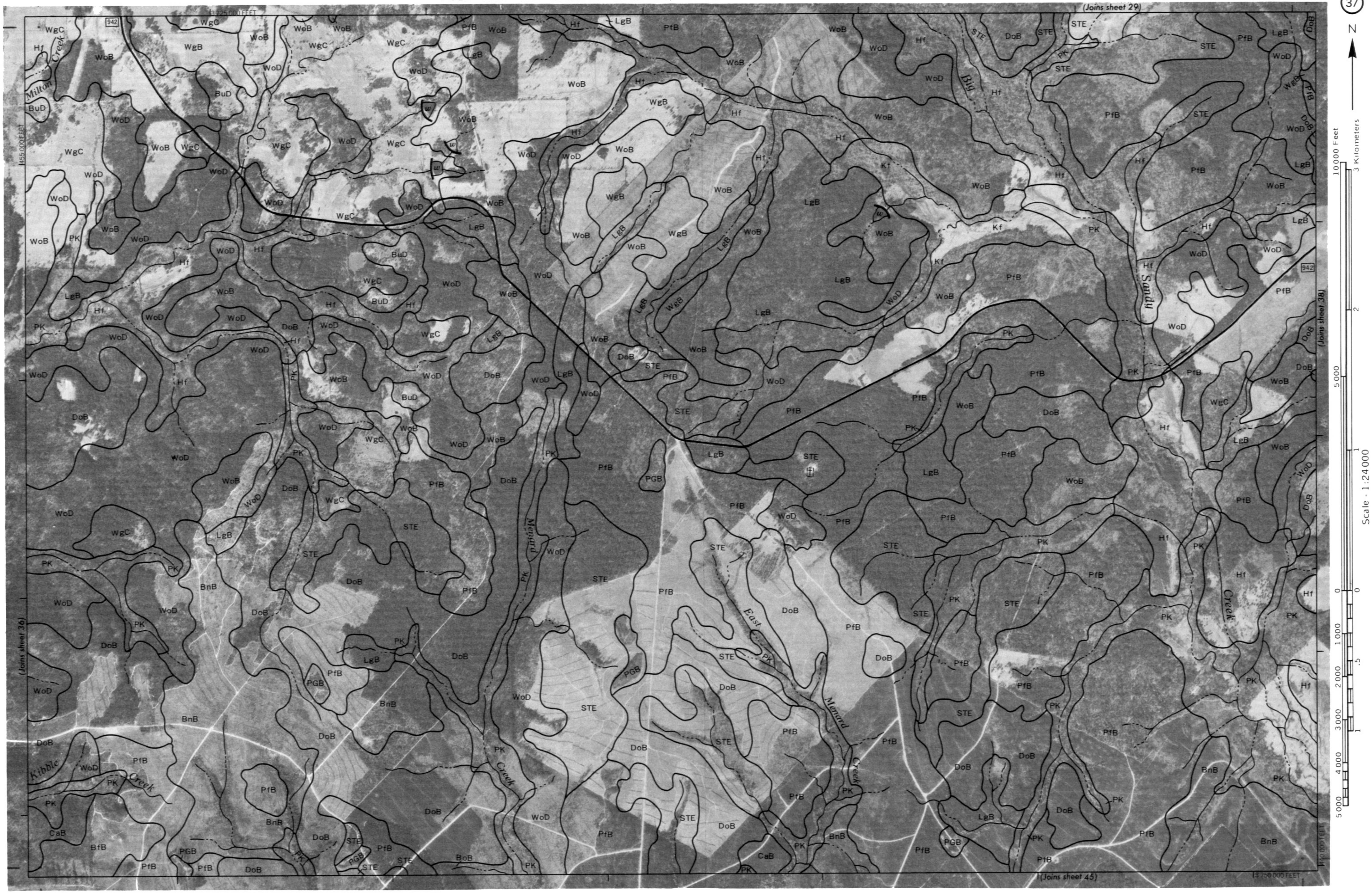

N
10000 Feet
3 Kilometers
Scale - 1:24 000
(Joins sheet 24)
(Joins sheet 40)
(Joins sheet 33)
(Joins inset B, sheet 23)
3 600 000 FEET
3 575 000 FEET
946
980
Lake Livingston
Pools Creek
Caroline Creek
East Caroline Creek
Deans Creek
Edwards Creek
Palmetto Branch
Palmetto Creek
Brushy Creek
Rocky Creek
Mill Creek
Branch
RaD
OaC
OaB
WgB
WgC
WoB
WoD
KM
LgB
DoB
BuD
BnB
Vs
Hf
PK
SrD
BfB
PfB
STE

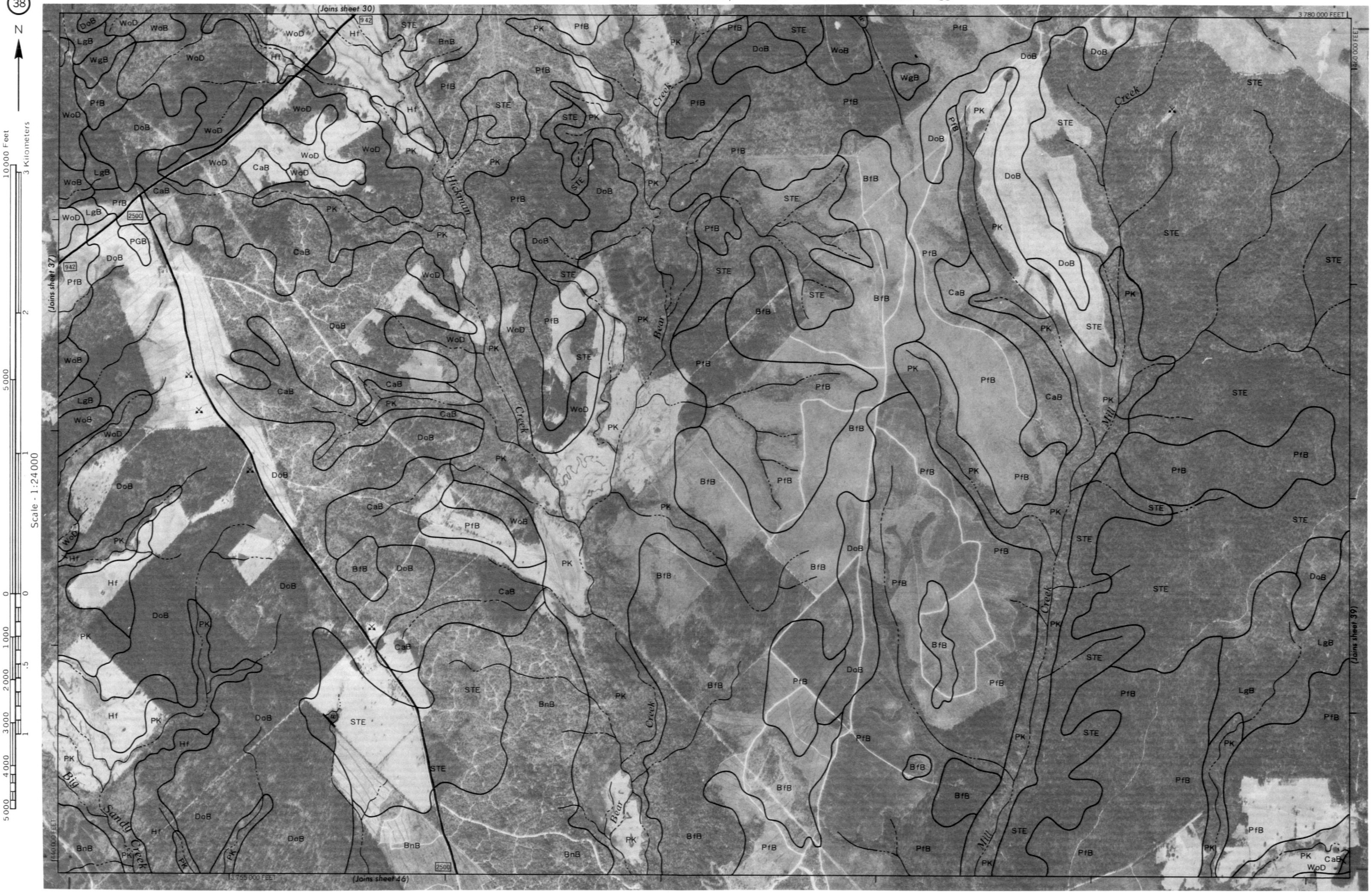

(Joins sheet 25)
(Joins sheet 34)
(Joins sheet 41)
(Joins sheet 32)
3 605 000 FEET
3 630 000 FEET
190
980
LAKE
LIVINGSTON
LAKE
LIVINGSTON
LAKE
LIVINGSTON
POLK
SAN JACINTO
COUNTY
COUNTY
Rocky
Creek
Mill
Creek
Darby Hill
Community
BnB
SrD
OaC
GaB
BuD
WgC
WoD
WoB
BeC
Vs
SrB
GaA
WgB
DoB
BfB
LgB
PaB
Hf
OaB
N
10 000 Feet
3 Kilometers
5000
2
1
Scale - 1:24 000
0
.5
1000
2000
3000
4000
5000

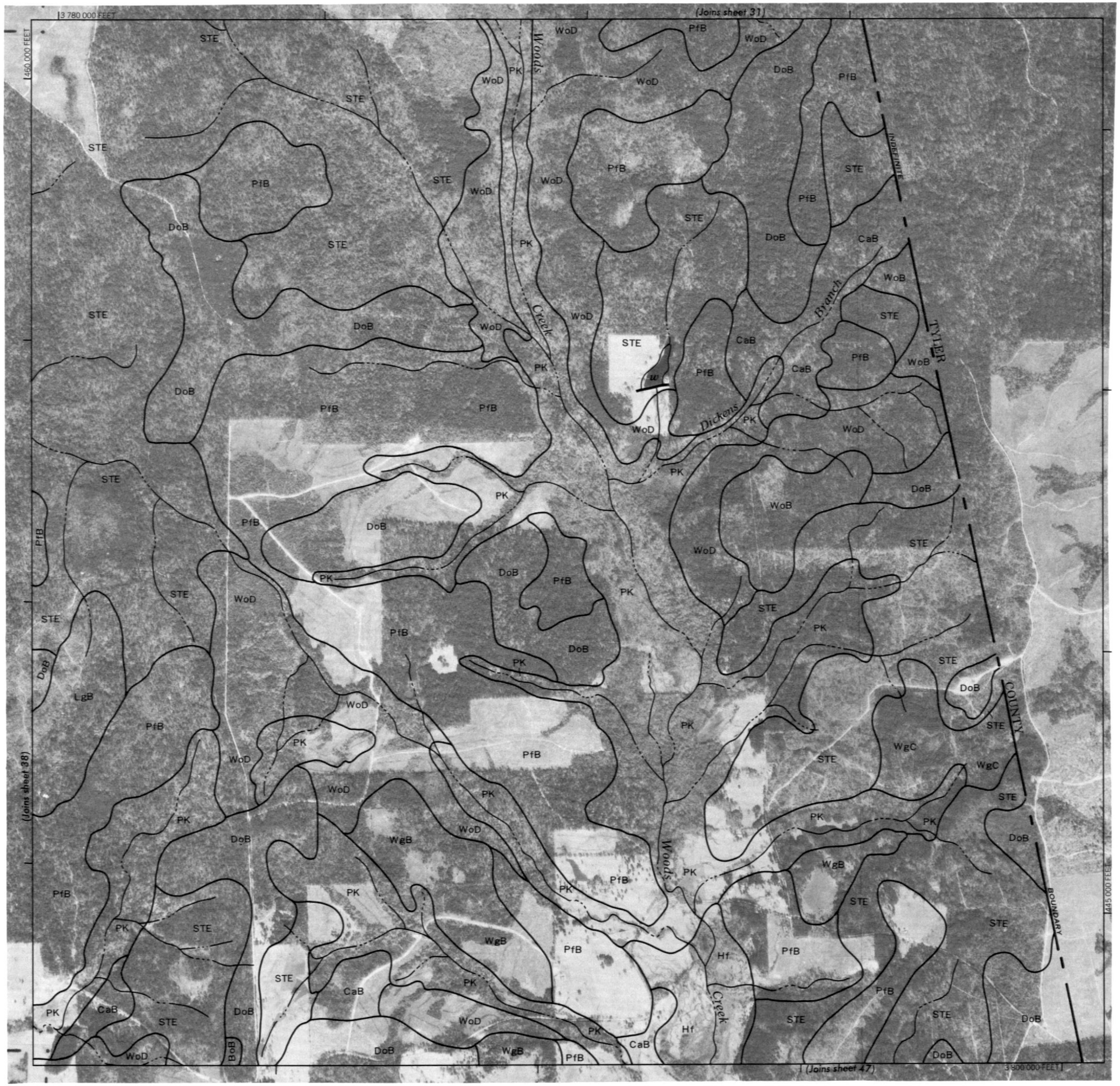

N
(Joins sheet 26)
(Joins sheet 33)
(Joins sheet 35)
(Joins sheet 42)
Onalaska
LAKE
LIVINGSTON
Lake Livingston
Sandy Creek
Caney Creek
Mooney Lake
water
POLK COUNTY
SAN JACINTO COUNTY
POLK COUNTY
SAN JACINTO COUNTY
10000 Feet
3 Kilometers
Scale - 1:24000
3 635 000 FEET
3 660 000 FEET
190
356
3186

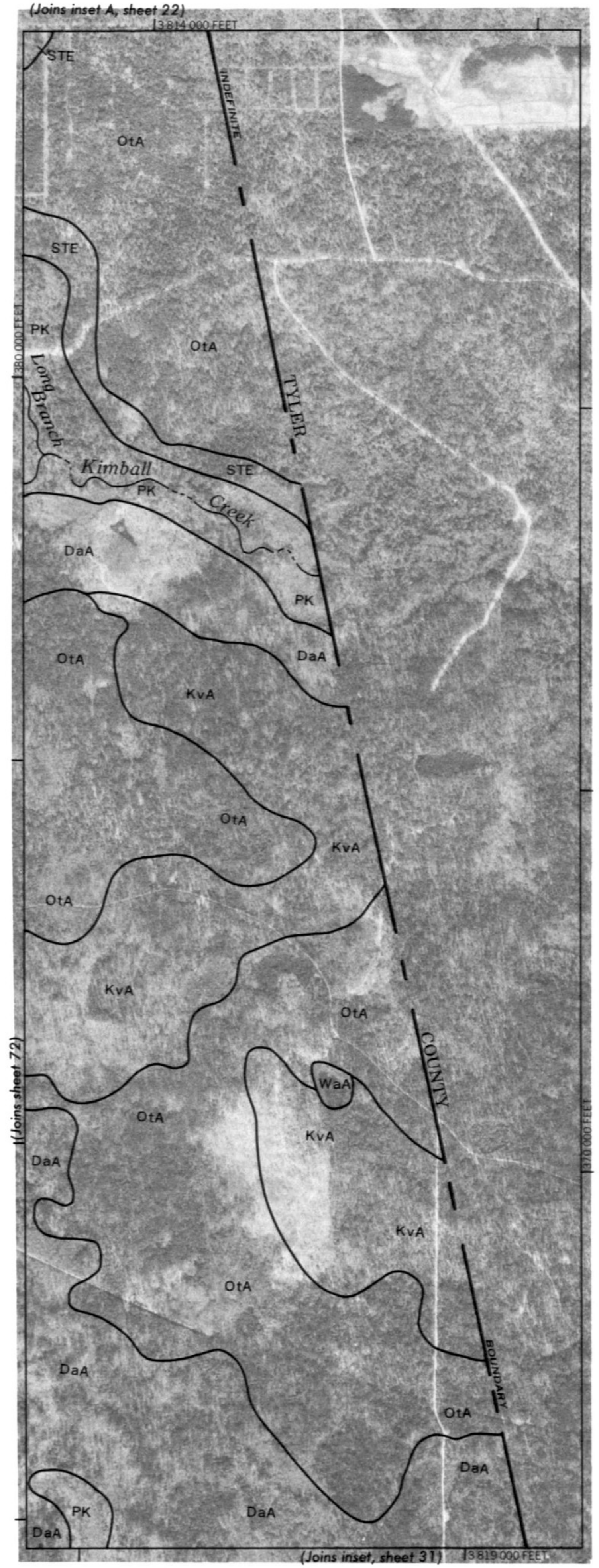

35
N
(Joins sheet 27)
(Joins sheet 36)
(Joins sheet 43)
(Joins sheet 34)
3 665 000 FEET
3 690 000 FEET
Manton Creek
Caney Creek
Plum Creek
Tempe Creek
East Tempe Creek
West Creek
Creek
350
190
WoD
WoB
PK
PfB
DoB
LgB
WgC
WgB
STE
BuD
PaB
CaB
Ha
Hf
BnB
w
10 000 Feet
5000
0
1000
2000
3000
4000
5000
3 Kilometers
2
1
.5
0
Scale - 1:24 000


N
10000 Feet
3 Kilometers
Scale - 1:24000
(Joins sheet 28)
(Joins sheet 35)
(Joins sheet 37)
(Joins sheet 44)
3 720 000 FEET
455 000 FEET
440 000 FEET
3 695 000 FEET
New Willard
Marston Community
Long Creek
Tom Creek
King Creek
Plum Creek
Alexander Creek
Milton Creek
Kibble Creek
SOUTHERN PACIFIC
water

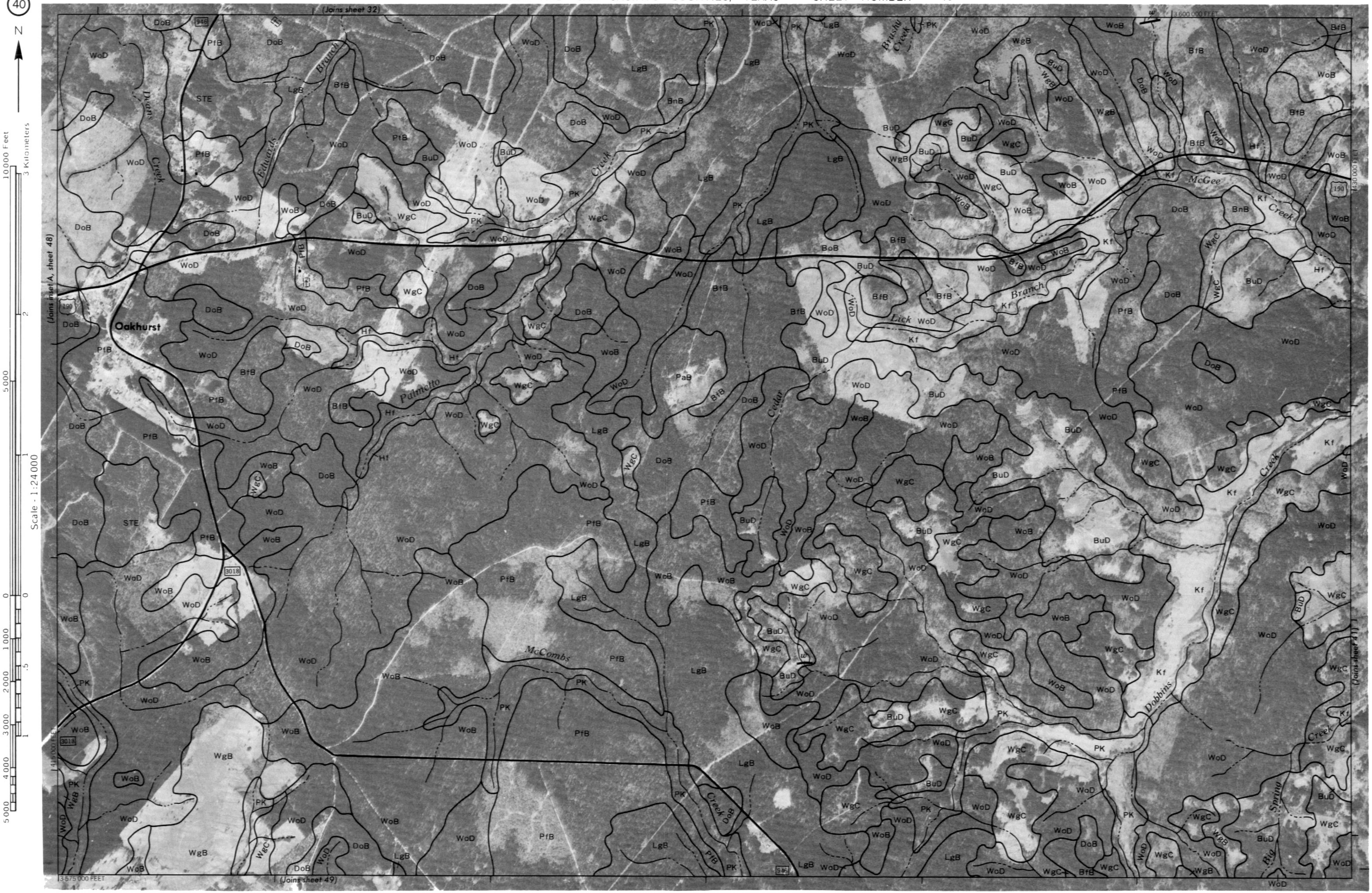

(Joins sheet 29)
(Joins sheet 38)
(Joins sheet 45)
(Joins sheet 36)
Milton Creek
Big Sandy Creek
Menard Creek
East Menard Creek
Kibble Creek
942
N
Scale - 1:24 000
10 000 Feet
3 Kilometers


N
Scale - 1:24000
10000 Feet
5000
0
1000
2000
3000
4000
5000
3 Kilometers
2
1
.5
0
(Joins sheet 30)
(Joins sheet 37)
(Joins sheet 39)
(Joins sheet 46)
3 780 000 FEET
1 450 000 FEET
1 440 000 FEET
3 755 000 FEET
942
2500
Hickman Creek
Bear Creek
Mill Creek
Big Sandy Creek
Creek
DoB
WoD
WoB
LgB
WgB
PfB
CaB
PGB
Hf
STE
BnB
PK
BfB





39
N
Scale - 1:24 000
10 000 Feet
5 000
0
1 000
2 000
3 000
4 000
5 000
3 Kilometers
2
1
0
.5
1


N
(Joins sheet 32)
(Joins sheet 49)
(Joins inset A, sheet 48)
(Joins sheet 41)
Oakhurst
Deans Creek
Edwards Creek
Branch
Brushy Creek
McGee Creek
Lick Branch
Palmetto
Cedar
McCombs
Dobbins Creek
Big Spring Creek
Creek
190
3018
946
3 600 000 FEET
3 575 000 FEET
Scale - 1:24000
10 000 Feet
3 Kilometers
5000
1000
2000
3000
4000
0
.5
1
2


41
N
(Joins sheet 33)
(Joins sheet 42)
(Joins sheet 50)
(Joins sheet 40)
Liberty Hill
Pointblank
Snow Hill
LAKE
LIVINGSTON
LAKE
LIVINGSTON
POLK
SAN JACINTO
COUNTY
COUNTY
Mill
Creek
McGee
Creek
Dobbins
Creek
Big
Spring
Creek
Creek
Morris
190
156
980
WoD
WoB
BfB
BuD
DoB
BeC
GaA
GaB
BnB
PK
WgB
LgB
Hf
WgC
Kf
3 605 000 FEET
3 630 000 FEET
420 000 FEET
10 000 Feet
5000
0
1000
2000
3000
4000
5 000
3 Kilometers
2
1
.5
0
Scale - 1:24 000

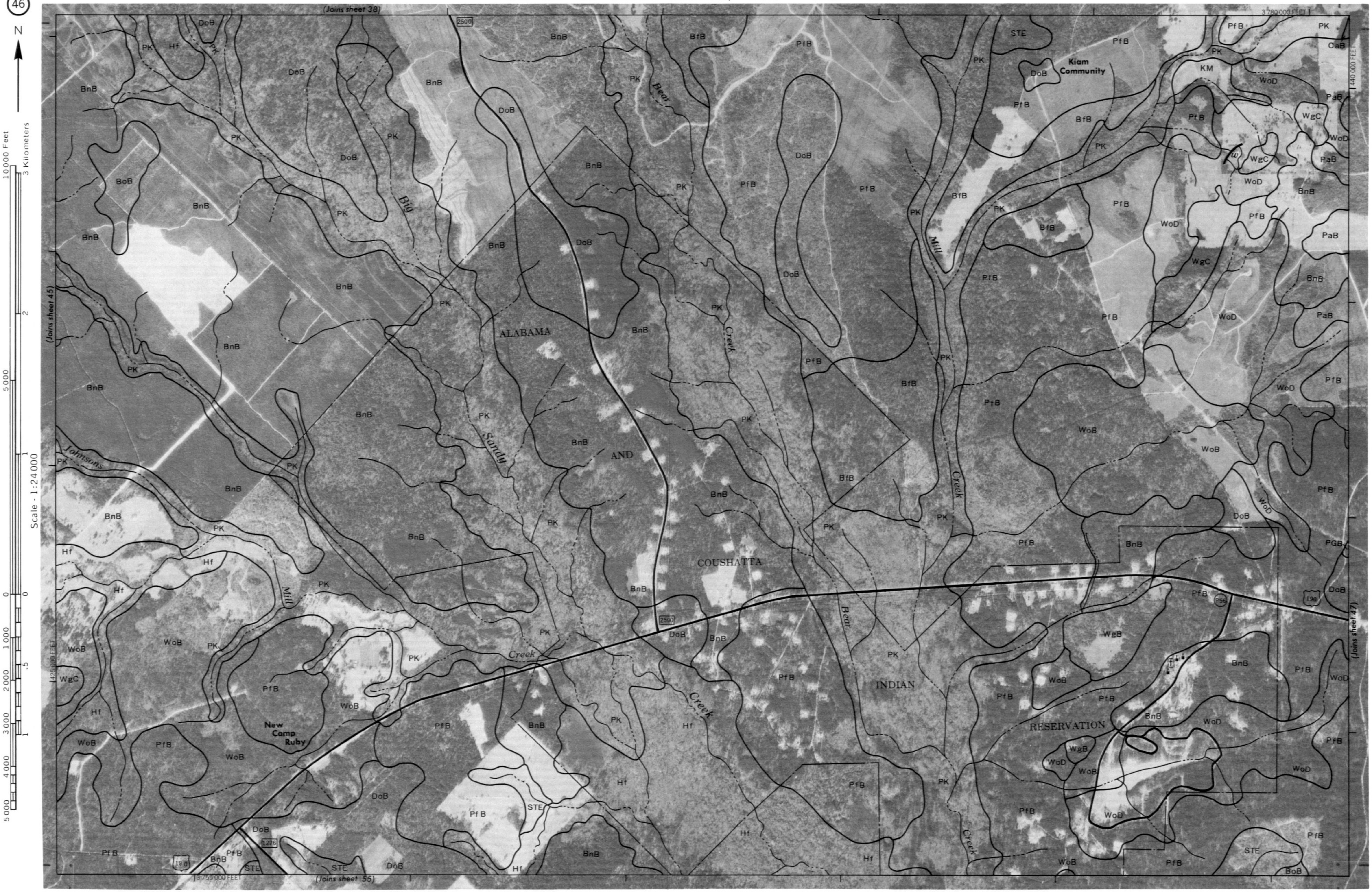

42
SAN JACINTO COUNTY
POLK COUNTY
N
(Joins sheet 34)
(Joins sheet 41)
(Joins sheet 43)
(Joins sheet 51)
LAKE
LIVINGSTON
LAKE
LIVINGSTON
LAKE
LIVINGSTON
Blanchard
Tobacco Patch Community
Black Branch
Jennings Branch
Branch
West Tempe Creek
Scale - 1:24 000
10000 Feet
5000
0
1000
2000
3000
4000
5000
3 Kilometers
2
1
.5
0
1
3 635 000 FEET
3 660 000 FEET
420 000 FEET
2457
3277
3126
WoB
WoD
BeB
BeC
GaA
GaB
WaA
CaB
DoB
BnB
PfB
PK
LgB
WgB
SrB
PaB

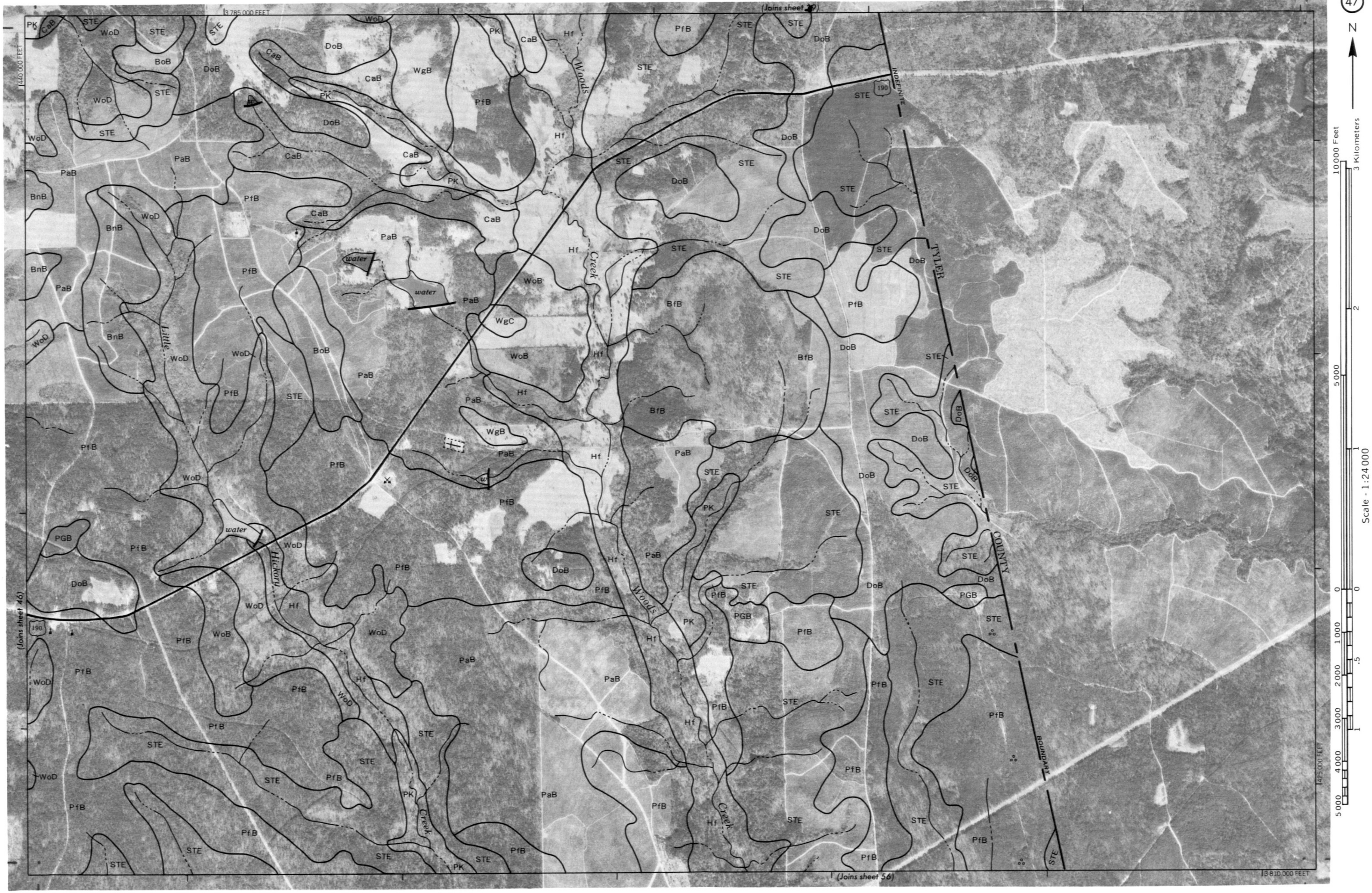

43
N
(Joins sheet 35)
(Joins sheet 42)
(Joins sheet 44)
(Joins sheet 52)
3 690 000 FEET
West Tempe Creek
East Tempe Creek
Tempe Creek
KING CREEK
LONG KING
LAKE LIVINGSTON
190
2457
350
3126
59
10000 Feet
3 Kilometers
Scale - 1:24 000
5000
0
1000
2000
3000
4000
5 000
WoB
WoD
DoB
PfB
PK
CaB
STE
Hf
Ha
GaA
GaB
BnB
BeB
WaA
PaB
WgB
WgC
BuD
SrB
Vs
BoB


44
N
10000 Feet
3 Kilometers
Scale - 1:24000
(Joins sheet 36)
(Joins sheet 43)
(Joins sheet 45)
(Joins sheet 53)
LONG KING CREEK
Israel Community
LIVINGSTON
(county seat)
Choates Creek
Crystal Lakes
Beech Creek
SOUTHERN
PACIFIC
water

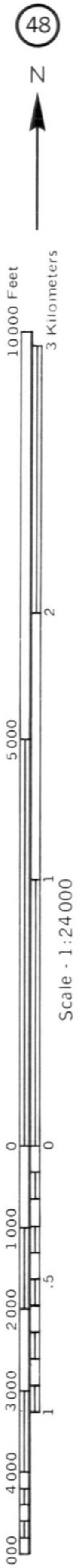
45

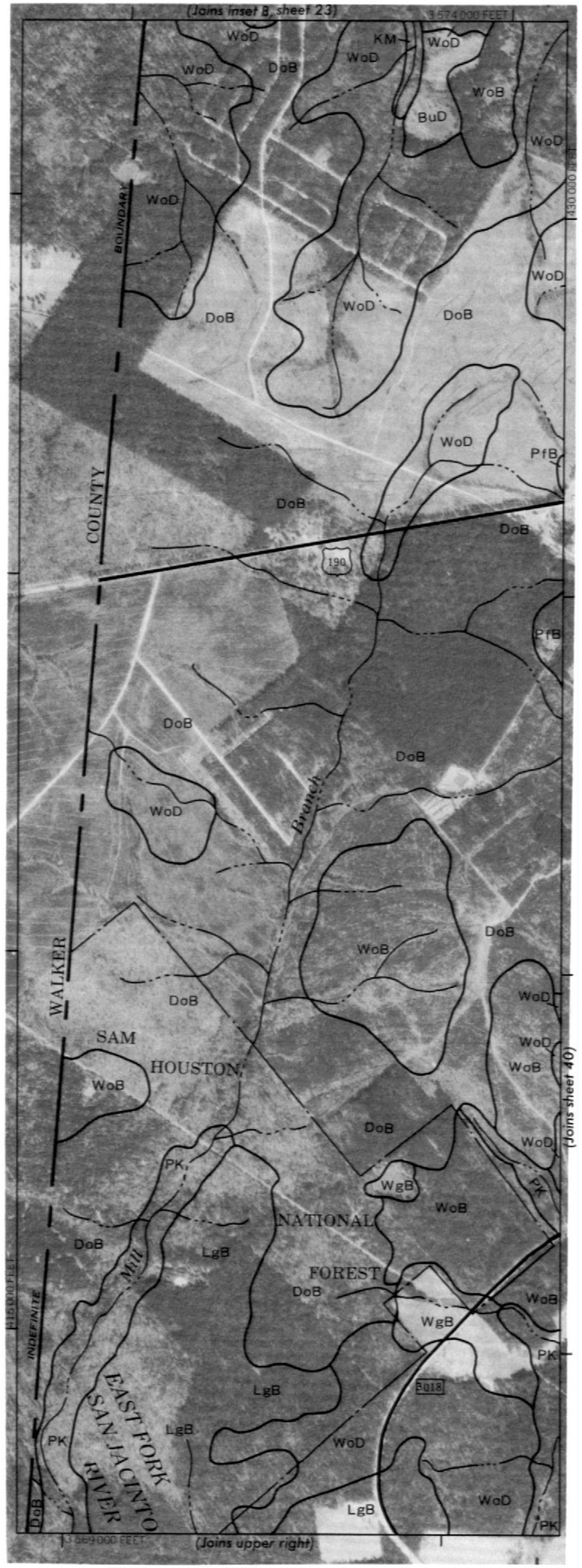

(Joins sheet 37)
(Joins sheet 46)
(Joins sheet 54)
(Joins sheet 44)
3 725 000 FEET
3 750 000 FEET
435 000 FEET
Menard Creek
East Menard Creek
Johnsons Mill Creek
Beach Creek
Bluff Creek
N
3 Kilometers
10 000 Feet
Scale - 1:24 000


N
10000 Feet
3 Kilometers
Scale - 1:24000
(Joins sheet 38)
(Joins sheet 45)
(Joins sheet 47)
(Joins sheet 55)
3 780 000 FEET
440 000 FEET
3 755 000 FEET
Kiam Community
New Camp Ruby
ALABAMA
AND
COUSHATTA
INDIAN
RESERVATION
Big
Sandy
Creek
Bear
Creek
Mill
Creek
Johnsons
Mill
Creek
2500
190
1276
BnB
BfB
BoB
CaB
DoB
Hf
KM
PaB
PfB
PGB
PK
STE
WgB
WgC
WoB
WoD

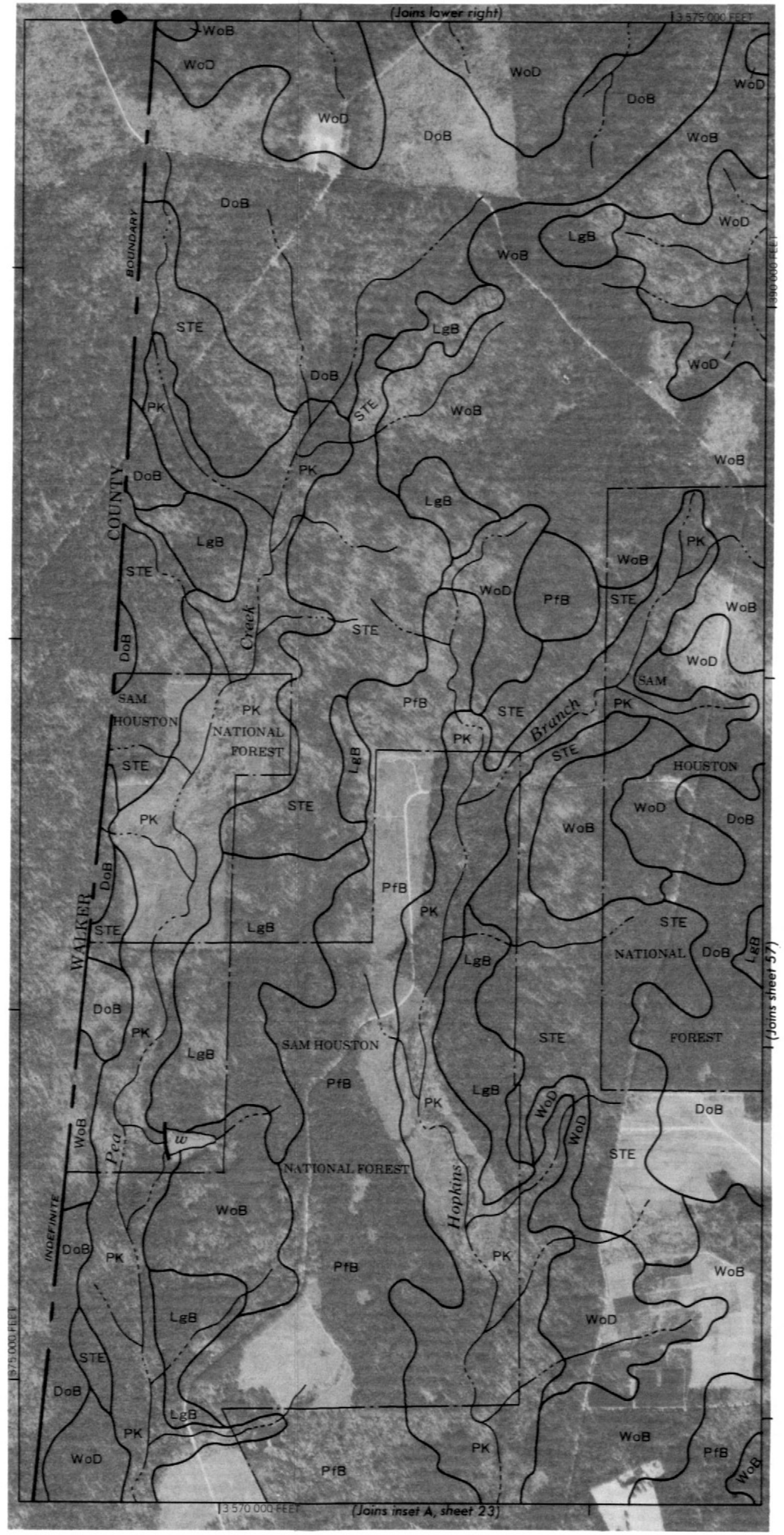

47
N
(Joins sheet 39)
(Joins sheet 46)
(Joins sheet 56)
3 785 000 FEET
3 810 000 FEET
440 000 FEET
425 000 FEET
Woods Creek
Little Hickory Creek
TYLER COUNTY BOUNDARY
INDEFINITE
190
water
STE
PfB
PaB
DoB
WoD
WoB
CaB
BoB
BnB
BfB
WgB
WgC
Hf
PK
PGB
1 Kilometers 2 3
1 Mile 0 .5
Feet 10 000 5000 1000 0 1000 2000 3000 4000 5000
Scale - 1:24 000

48

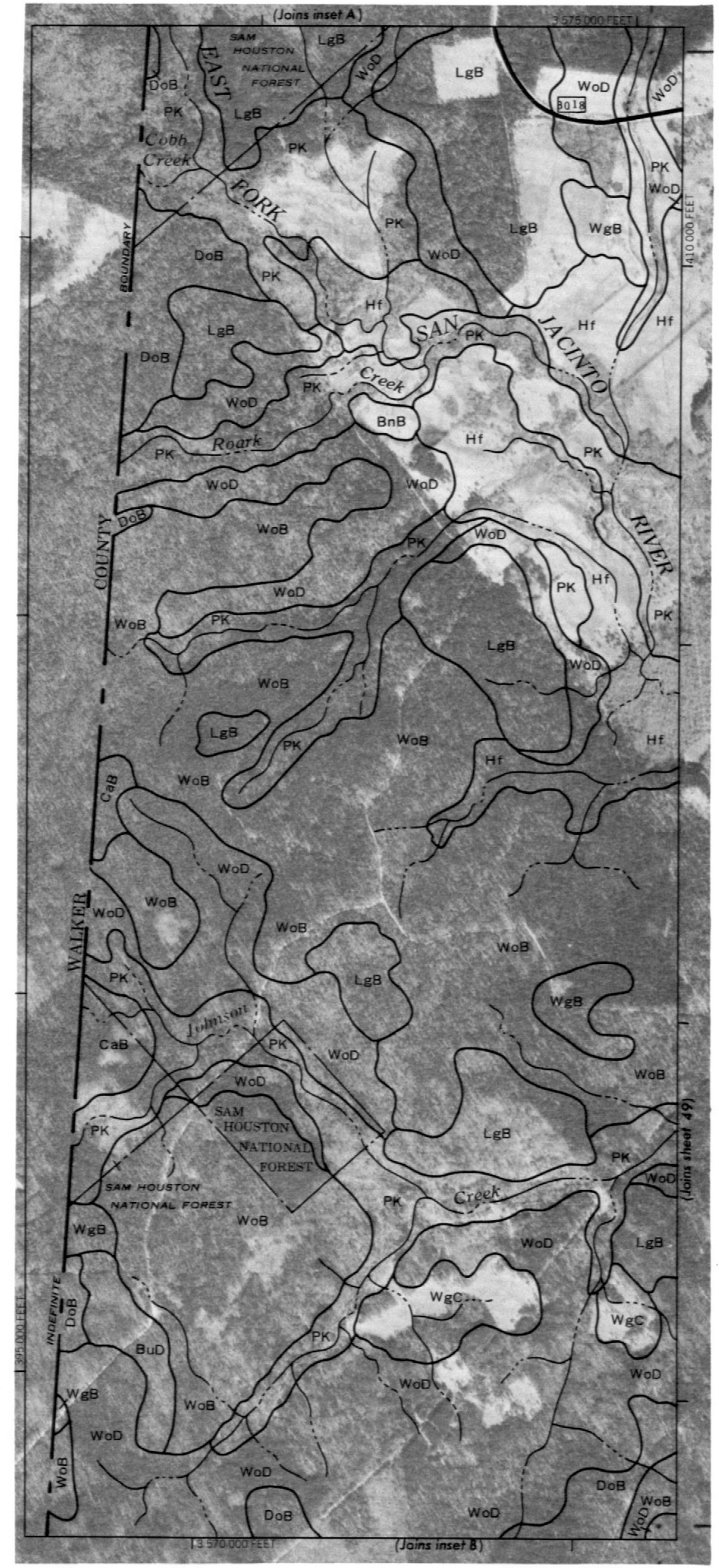


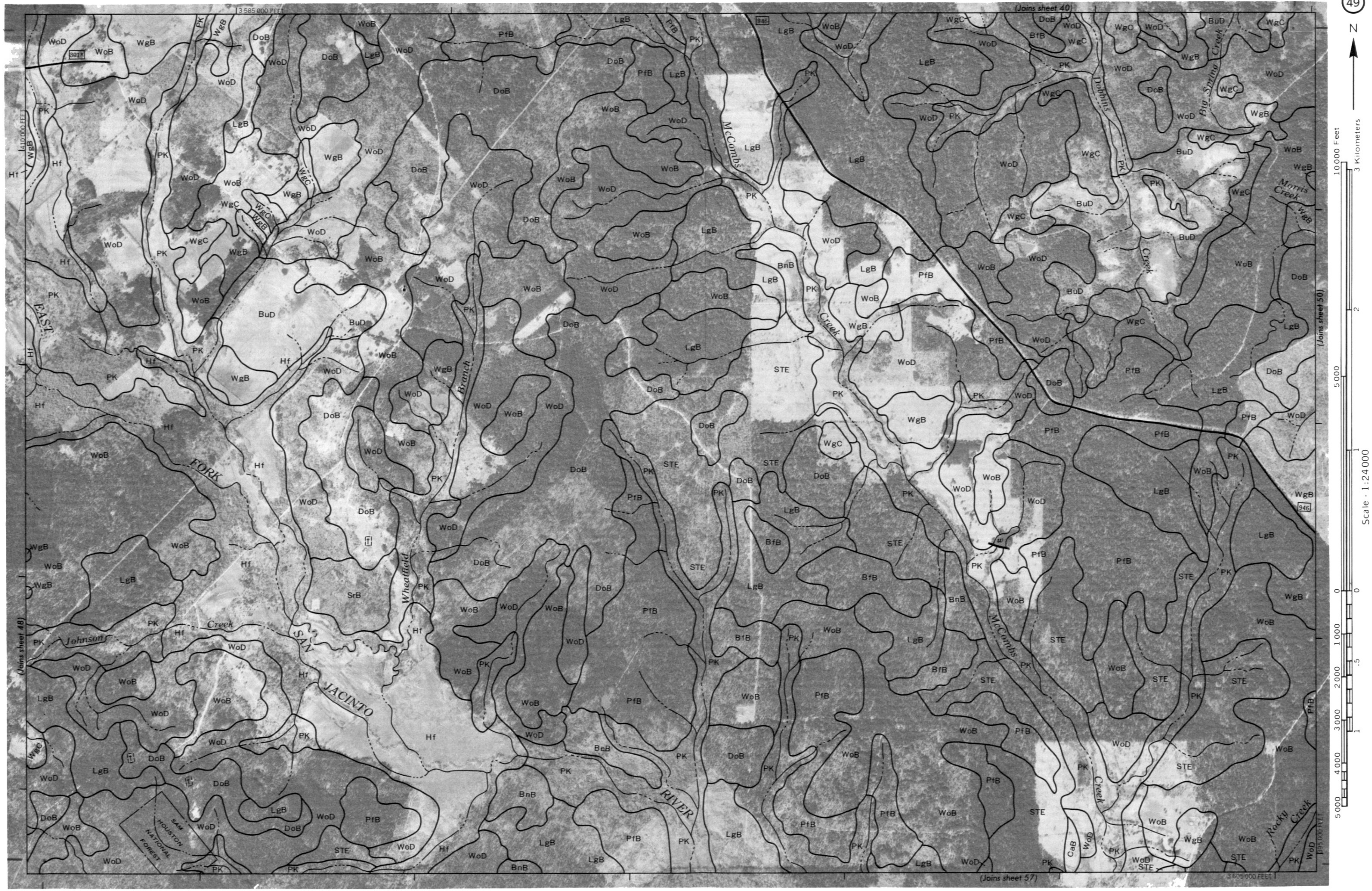


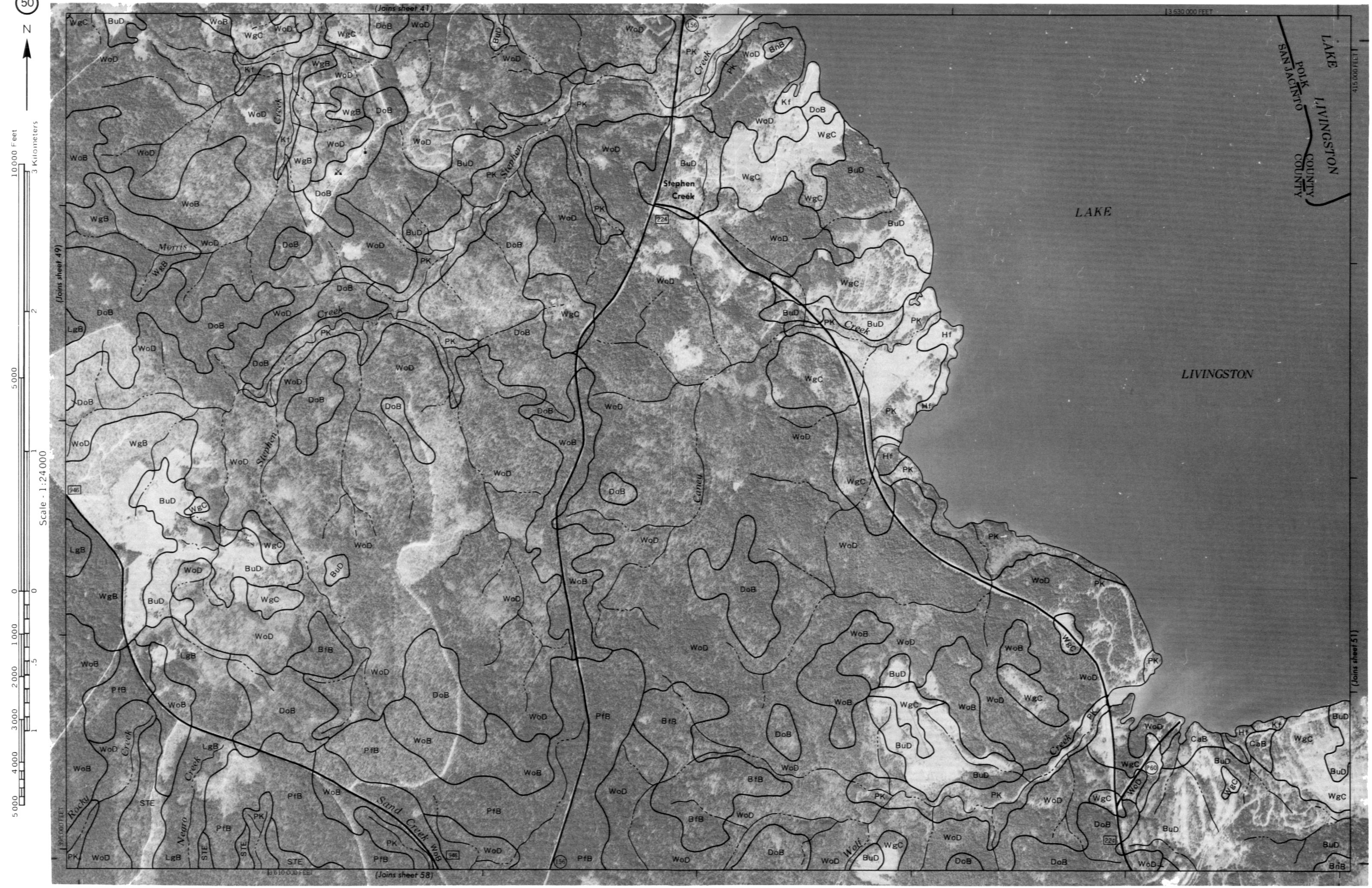
INSET A

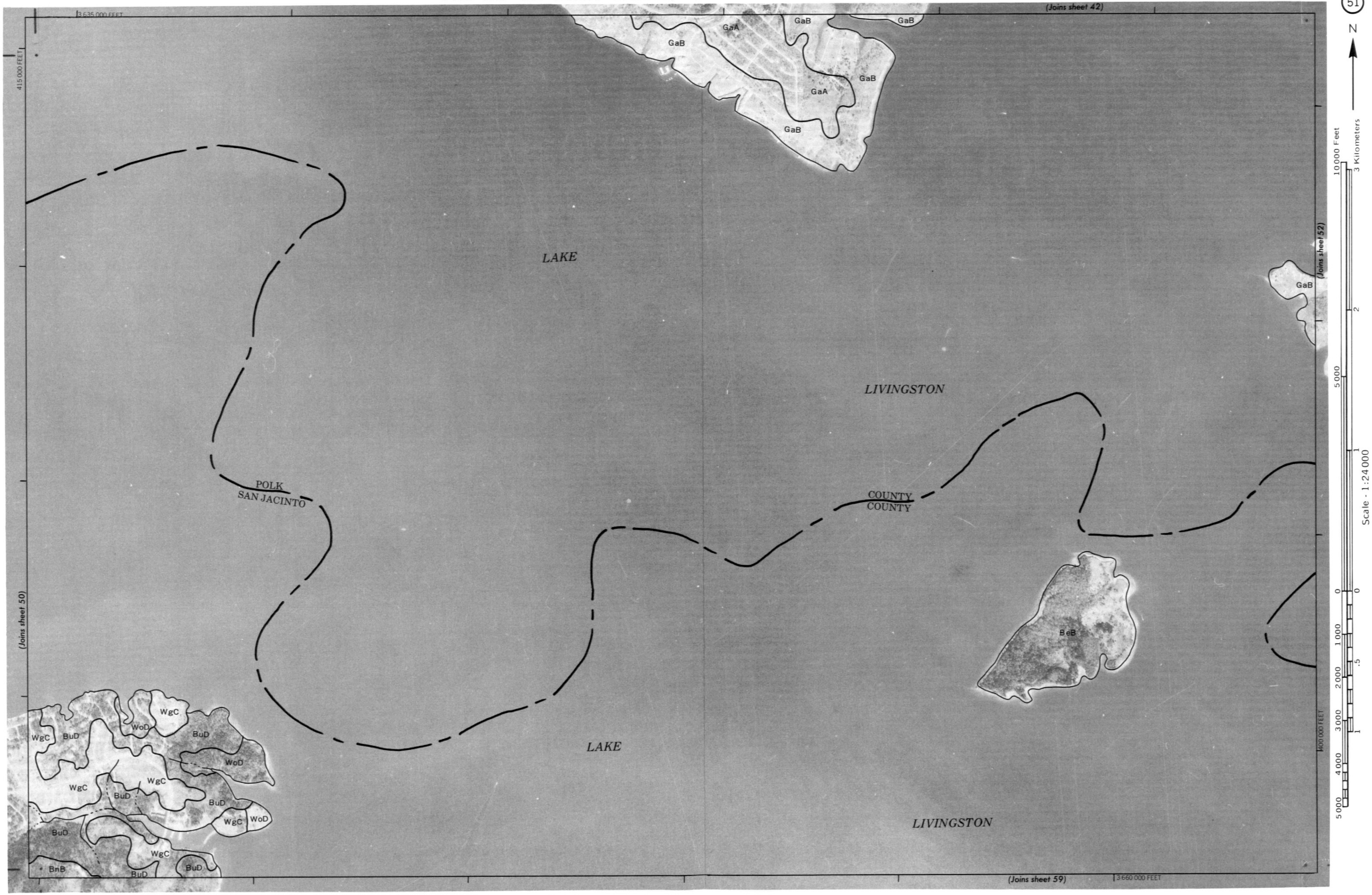


INSET B

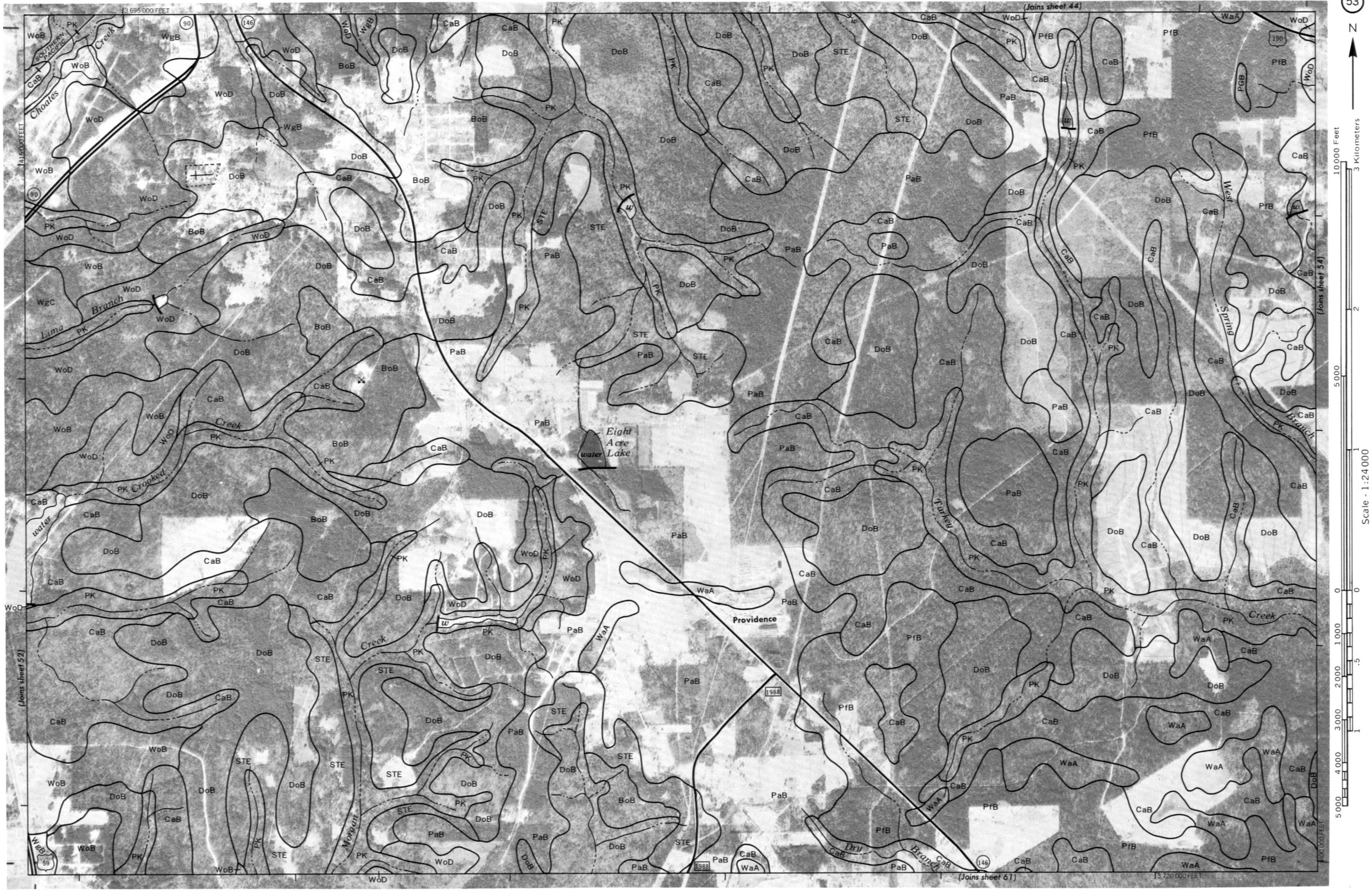



(Joins sheet 40)
(Joins sheet 48)
(Joins sheet 50)
(Joins sheet 57)
3 585 000 FEET
3 605 000 FEET
1 410 000 FEET
1 385 000 FEET
EAST
FORK
SAN
JACINTO
RIVER
Johnson
Creek
Wheatfield
Branch
McCombs
Creek
Dobbins
Big Spring Creek
Morris Creek
Rocky Creek
SAM HOUSTON NATIONAL FOREST
946
3018
N
10 000 Feet
5000
0
3 Kilometers
Scale - 1:24 000


N
10 000 Feet
3 Kilometers
Scale - 1:24 000
(Joins sheet 41)
(Joins sheet 49)
(Joins sheet 51)
(Joins sheet 58)
LAKE LIVINGSTON
LAKE
LIVINGSTON
POLK COUNTY
SAN JACINTO COUNTY
Stephen Creek
Morris
Creek
Caney
Sand Creek
Rocky Creek
Negro Creek
Wolf Creek


51
N
(Joins sheet 42)
(Joins sheet 52)
(Joins sheet 50)
(Joins sheet 59)
3 635 000 FEET
3 660 000 FEET
415 000 FEET
400 000 FEET
GaA
GaB
LAKE
LIVINGSTON
POLK
SAN JACINTO
COUNTY
COUNTY
BeB
LAKE
LIVINGSTON
WgC
BuD
WoD
BnB
Scale - 1:24 000
10 000 Feet
5000
0
1000
2000
3000
4000
5000
3 Kilometers
2
1
.5
0


N
10000 Feet
3 Kilometers
Scale 1:24 000
(Joins sheet 43)
(Joins sheet 51)
(Joins sheet 53)
(Joins sheet 60)
3 665 000 FEET
3 690 000 FEET
400 000 FEET
Lake
Livingston
Moore Hill
Community
LIVINGSTON
MUNICIPAL AIRPORT
LAKE
LIVINGSTON
LAKE
LIVINGSTON
POLK
SAN JACINTO
COUNTY
COUNTY
LAKE
LIVINGSTON
STATE
PARK
HENNINGTON AIRFIELD
AIRSTRIP
(PVT)
Tempe
Creek
LONG
KING
CREEK
Choates
Creek
Lima
Branch
Crooked
Creek
PACIFIC
SOUTHERN
water

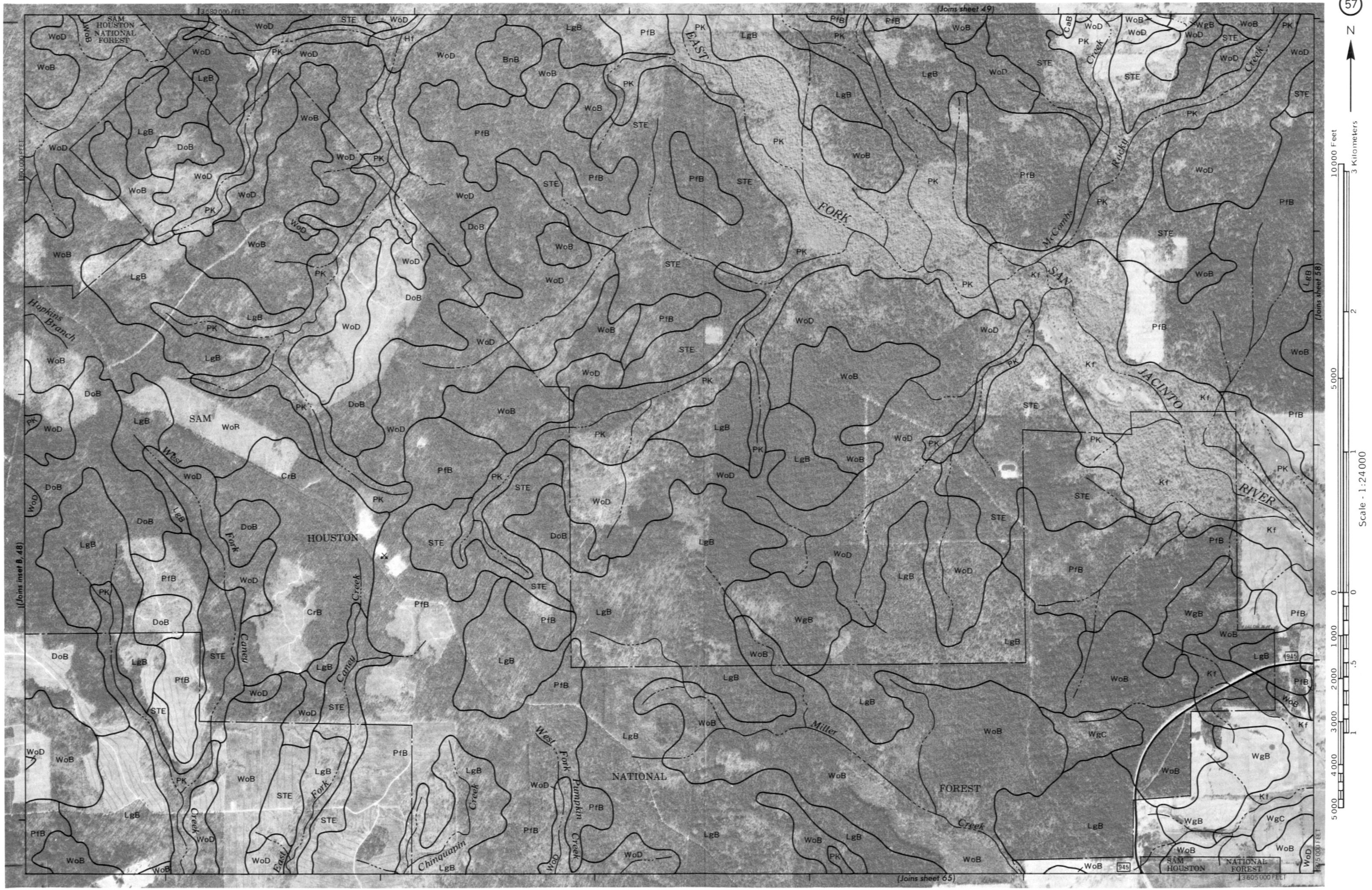

(Joins sheet 44)
(Joins sheet 54)
(Joins sheet 61)
(Joins sheet 52)
3 695 000 FEET
3 720 000 FEET
Eight Acre Lake
water
Providence
Choates Creek
Lima Branch
Crooked Creek
Turkey Creek
Morgan Creek
West Spring Branch
Dry Branch
SOUTHERN PACIFIC
N
Scale - 1:24 000
10000 Feet
3 Kilometers

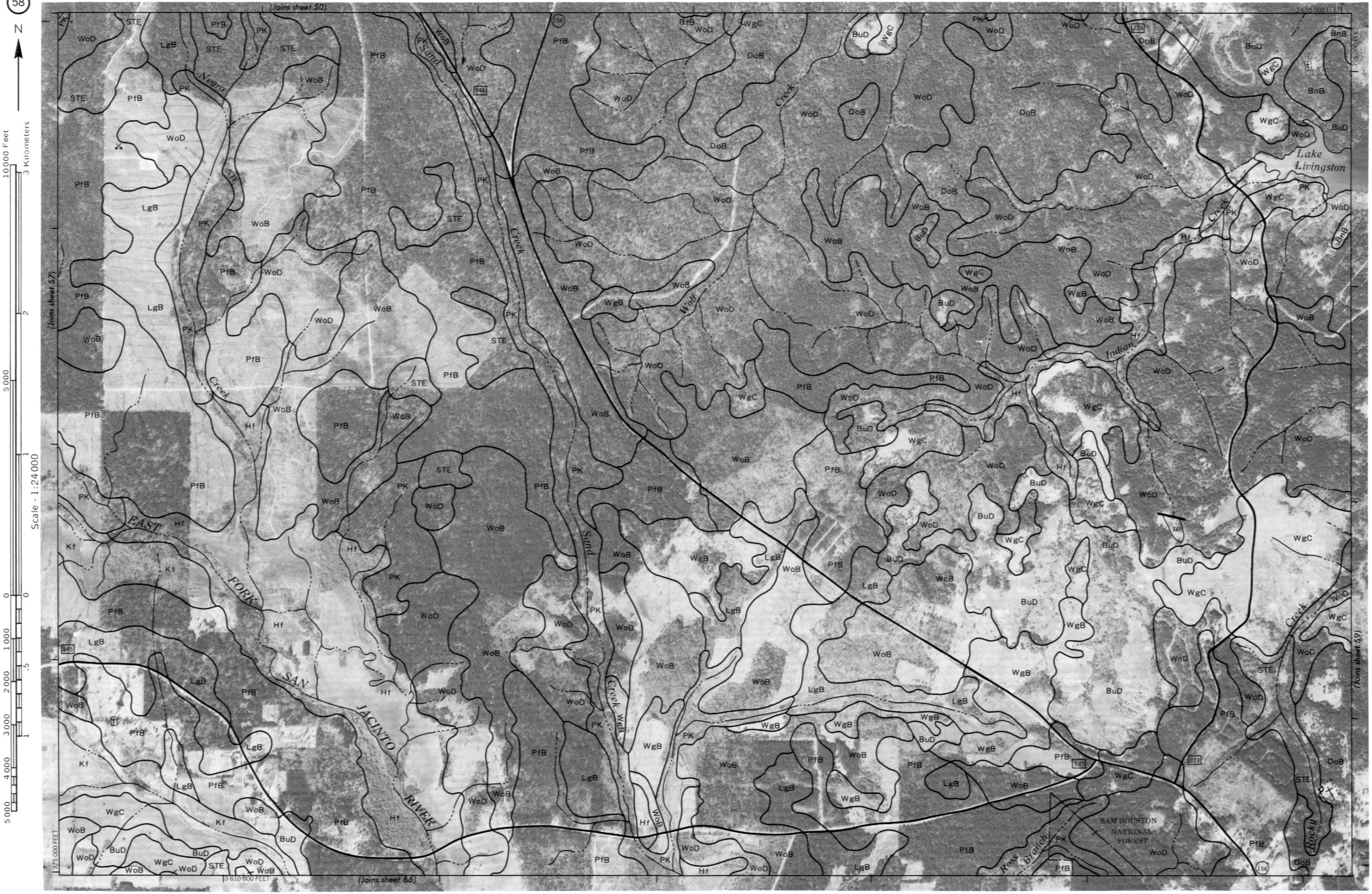

N
10000 Feet
3 Kilometers
Scale - 1:24 000
(Joins sheet 45)
(Joins sheet 53)
(Joins sheet 55)
(Joins sheet 62)
3 750 000 FEET
3 725 000 FEET
Menard Creek
Bluff Creek
West Spring Branch
Turkey Creek
Mathis Branch
Menard Branch
Greenbriar Hollow
Yellow Branch
West Fork Double Branch
PfB
DoB
CaB
WoB
WoD
PK
STE
BnB
PGB
WaA
WgB
WgC
Hf

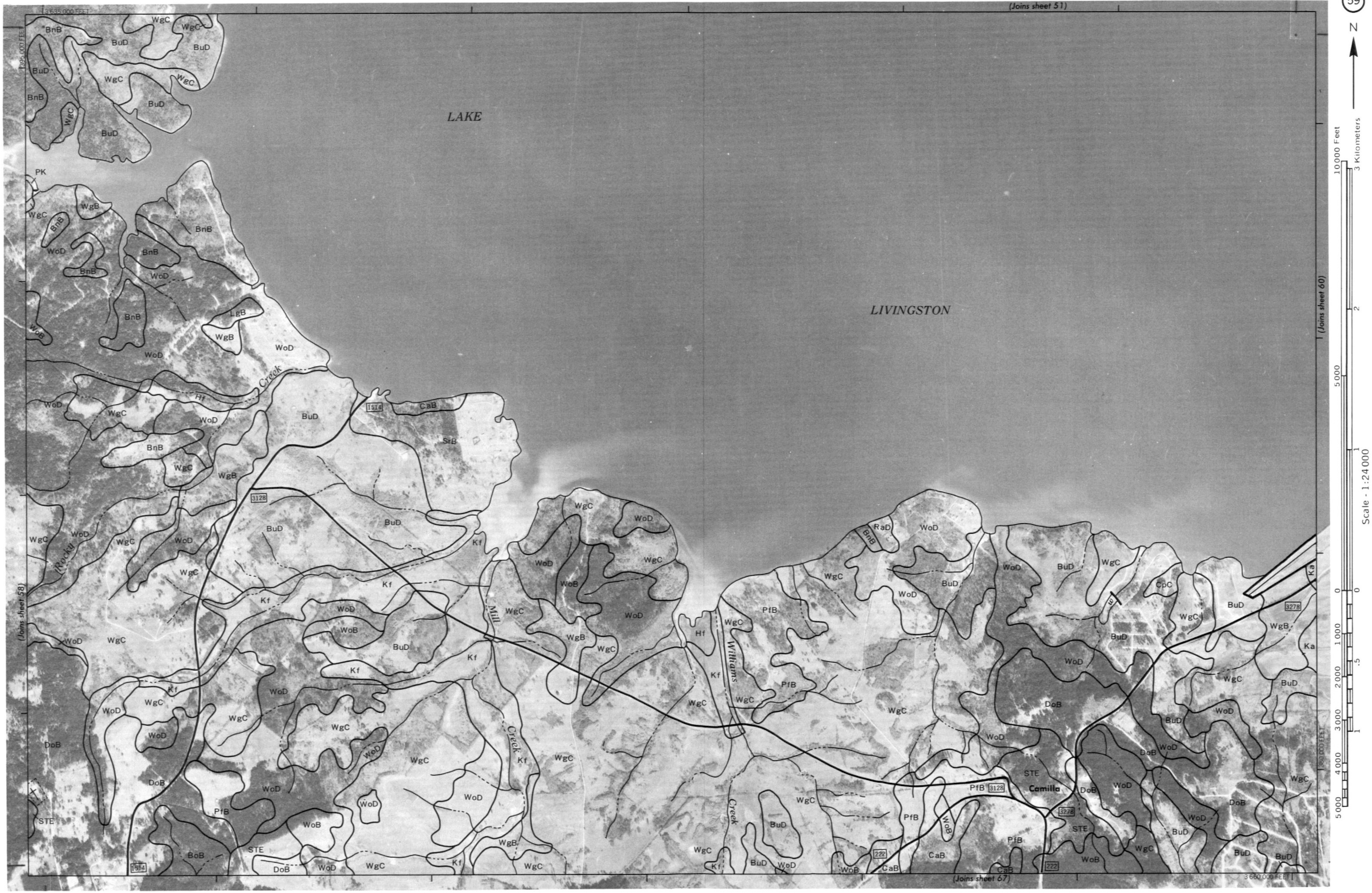
55


(Joins sheet 46)
ALABAMA AND COUSHATTA INDIAN RESERVATION
ALABAMA AND COUSHATTA PK
INDIAN RESERVATION
Big Sandy Creek
Bear Creek
Double A Lake
Camp Ruby
West Fork Double Branch
East Fork Double Branch
water
1276
190
(Joins sheet 56)
(Joins sheet 54)
(Joins sheet 63)
3 755 000 FEET
3 760 000 FEET
N
10 000 Feet
3 Kilometers
Scale - 1:24 000

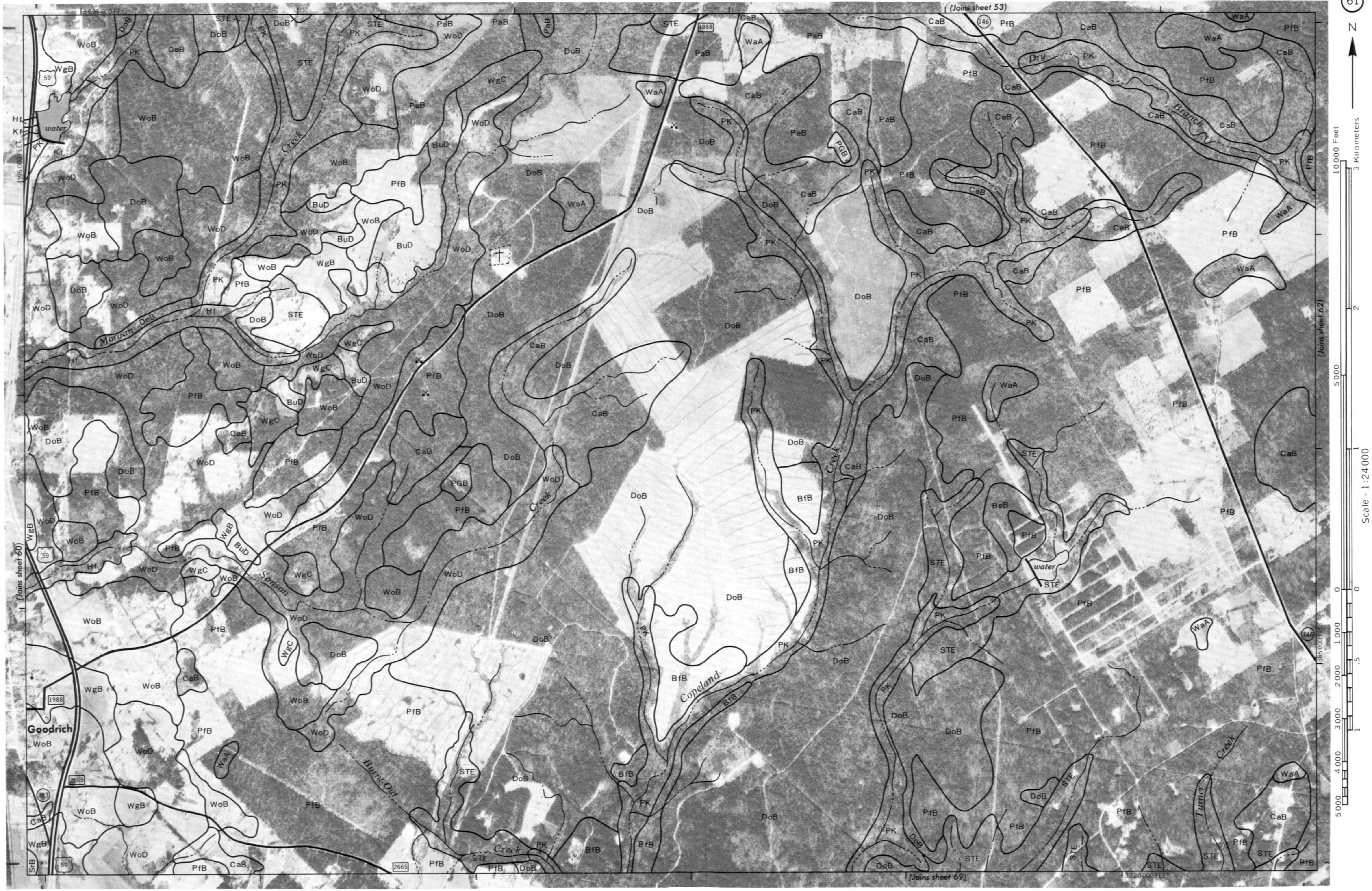

N
Scale - 1:24000
10000 Feet
5000
0
1000
2000
3000
4000
5000
3 Kilometers
2
1
.5
0
(Joins sheet 47)
(Joins sheet 55)
(Joins sheet 64)
3 810 000 FEET
3 785 000 FEET
Little Hickory Creek
Woods Creek
Hickory Creek
Kimball Creek
Little Kimball Creek
Long Branch
INDEFINITE
TYLER COUNTY BOUNDARY
STE
PfB
PK
PaB
BnB
BoB
DoB
BfB
PGB
WoB
Hf
BeC
BeB
CaB
WaA

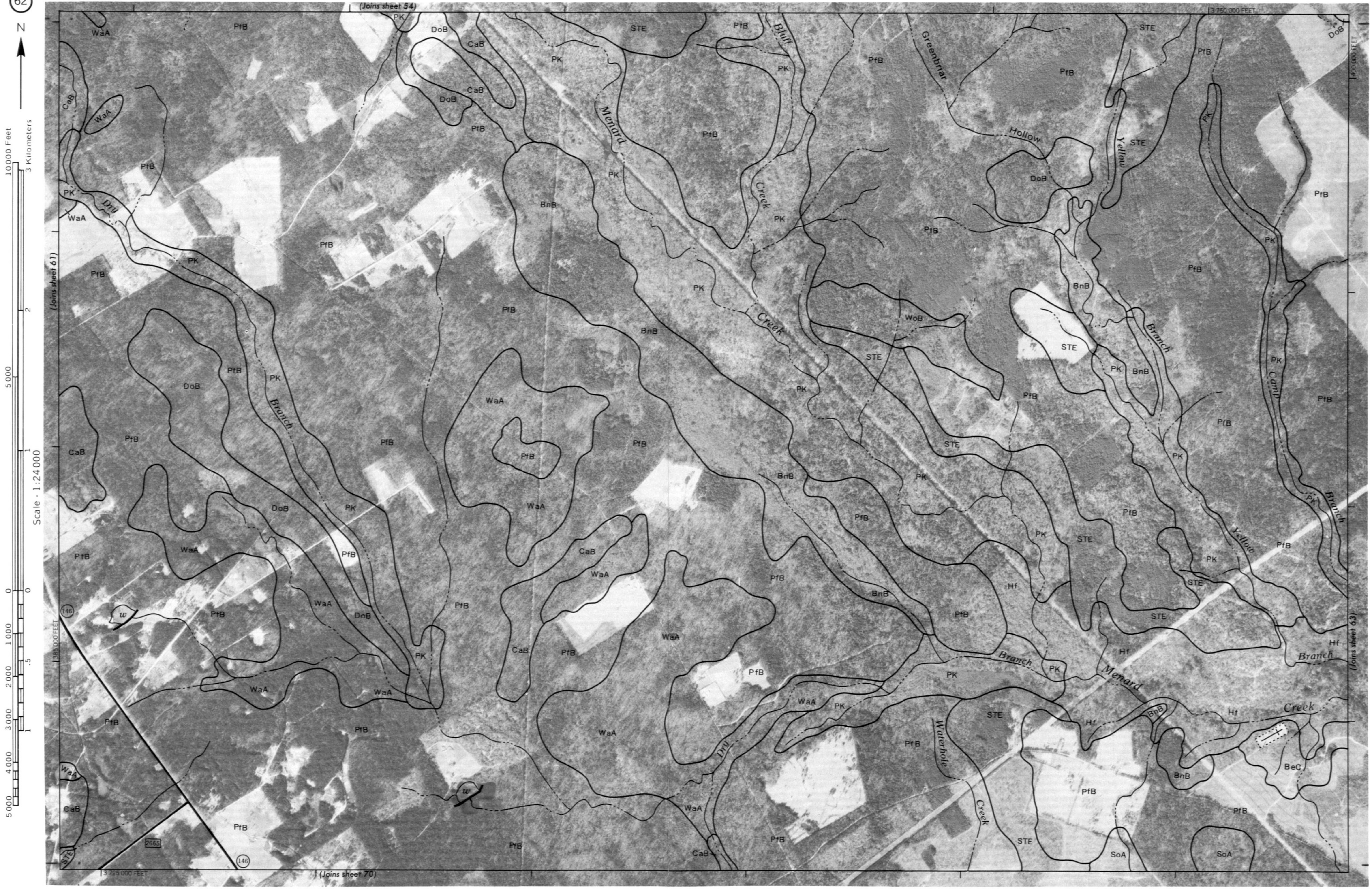

(Joins sheet 49)
(Joins sheet 58)
(Joins sheet 65)
(Joins inset 8, 48)
SAM HOUSTON NATIONAL FOREST
SAM
HOUSTON
NATIONAL
FOREST
EAST FORK SAN JACINTO RIVER
McCombs
Rocky
Creek
Hopkins Branch
West Fork
Caney Creek
Caney
East Fork
Creek
Chinquapin
West Fork
Pumpkin Creek
Miller Creek
945
3 580 000 FEET
3 605 000 FEET
N
Scale - 1:24000
10 000 Feet
5 000
0
3 Kilometers
2
1
.5


58
N
Scale - 1:24000
3 Kilometers
10000 Feet
5000
1000
2000
3000
4000
5000
(Joins sheet 50)
(Joins sheet 57)
(Joins sheet 59)
(Joins sheet 66)
3 635 000 FEET
3 610 000 FEET
375 000 FEET
Negro Creek
Sand Creek
Creek
Wolf
Indian Creek
Lake Livingston
EAST FORK
SAN JACINTO RIVER
Rocky Creek
Ross Branch
SAM HOUSTON NATIONAL FOREST
156
946
945
224
STE
WoD
WoB
PfB
LgB
PK
Hf
Kf
BuD
BnB
WgC
WgB
DoB


59
N
(Joins sheet 51)
(Joins sheet 60)
(Joins sheet 58)
(Joins sheet 67)
LAKE
LIVINGSTON
Rocky
Creek
Mill
Creek
Williams
Creek
Camilla
1514
3128
3278
222
10 000 Feet
5000
0
3 Kilometers
Scale - 1:24 000
BnB
BuD
WgC
WgB
WoD
WoB
LgB
CaB
StB
Hf
Kf
PK
DoB
PfB
STE
BoB
RaD
CpC
Ka

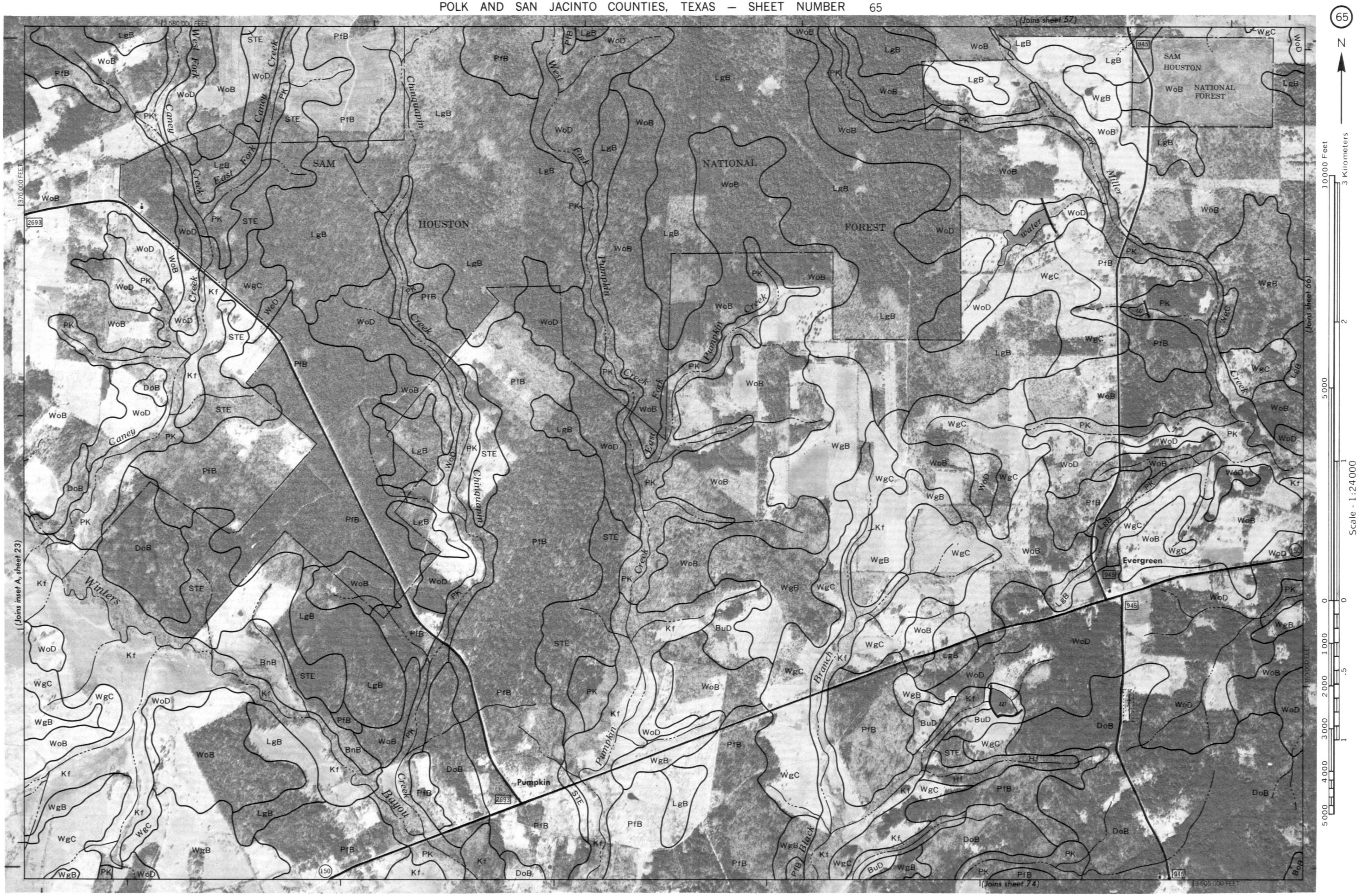

N
(Joins sheet 52)
(Joins sheet 59)
(Joins sheet 61)
(Joins sheet 68)
3 690 000 FEET
3 670 000 FEET
380 000 FEET
Scale - 1:24000
10000 Feet
5000
0
1000
2000
3000
4000
5000
3 Kilometers
2
1
.5
0
LAKE
Lake
Livingston
LIVINGSTON
POLK
SAN JACINTO
COUNTY
COUNTY
TRINITY
RIVER
Blue Lake
SOUTHLAND PARK
Laurent Lake
LONG
KING
CREEK
Morgan Creek
Sanson
Creek
SOUTHERN
PACIFIC
Goodrich
1988
3126
3278
2969
393
59

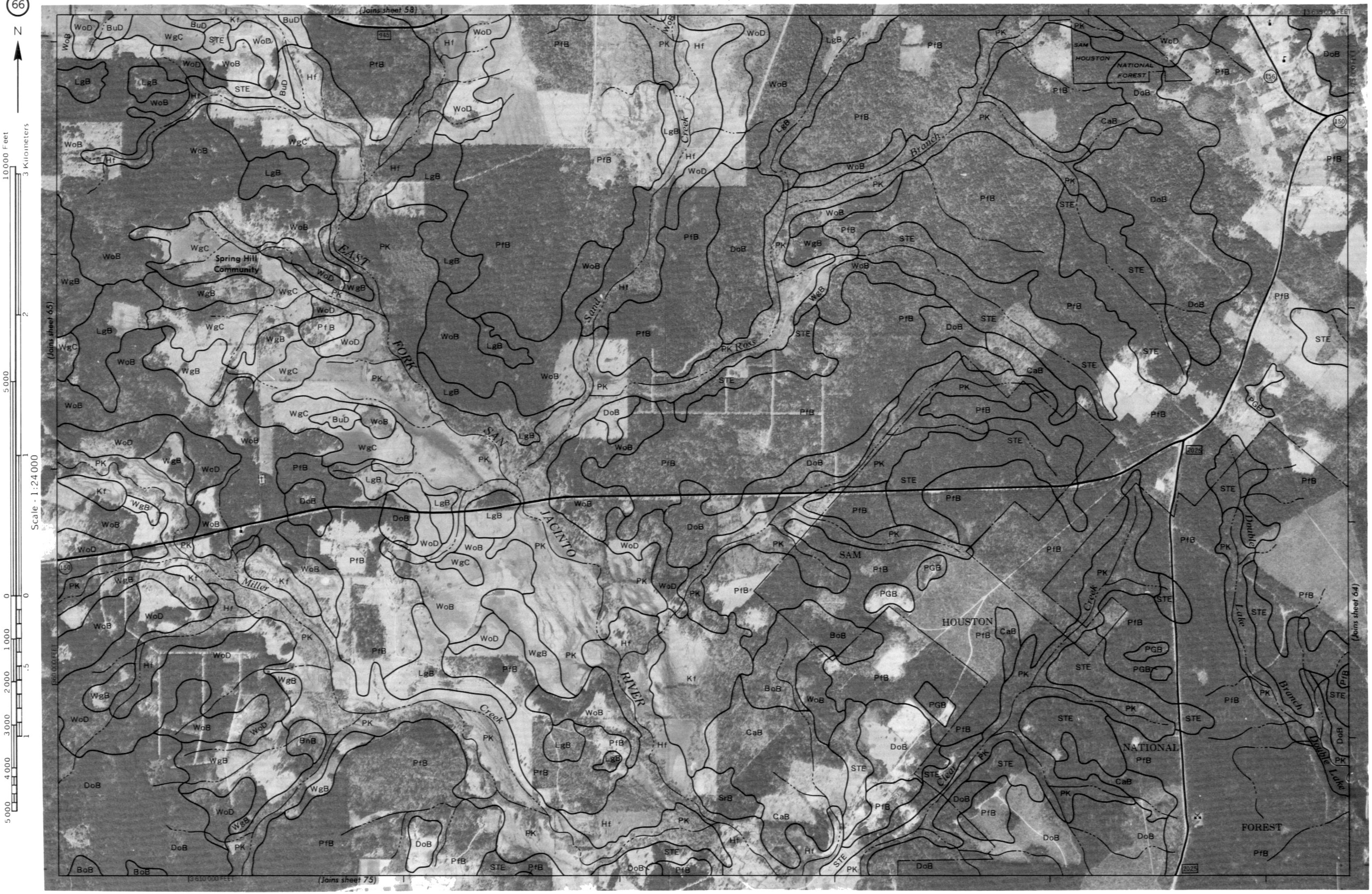

(Joins sheet 53)
(Joins sheet 62)
(Joins sheet 69)
(Joins sheet 60)
Goodrich
Morgan
Creek
Sanson
Burnt Out
Copeland
Dry
Branch
Turner
Creek
water
N
10 000 Feet
3 Kilometers
Scale - 1:24000
5000
1000
2000
3000
4000
0
1
2
.5


N
10 000 Feet
3 Kilometers
Scale 1:24 000
(Joins sheet 54)
(Joins sheet 61)
(Joins sheet 63)
(Joins sheet 70)
3 750 000 FEET
3 725 000 FEET
Menard Creek
Bluff Creek
Greenbriar Hollow
Yellow Branch
Camp Branch
Dry Branch
Dry Creek
Waterhole Creek
Branch
146
2665
PfB
PK
DoB
CaB
WaA
STE
BnB
WoB
Hf
BnB
BeC
SoA
w


63
N
(Joins sheet 55)
(Joins sheet 64)
(Joins sheet 71)
(Joins sheet 62)
3 755 000 FEET
400 000 FEET
West Fork Double Branch
East Fork Double Branch
Double Branch
Big Sandy Creek
Camp Branch
Yellow Branch
Menard Creek
water
1276
DoB
BoB
STE
PK
PaB
PfB
PGB
WoB
Hf
Ka
CaB
BeC
DaA
Scale - 1:24 000
10000 Feet
5000
1000
2000
3000
4000
0
3 Kilometers
2
1
.5

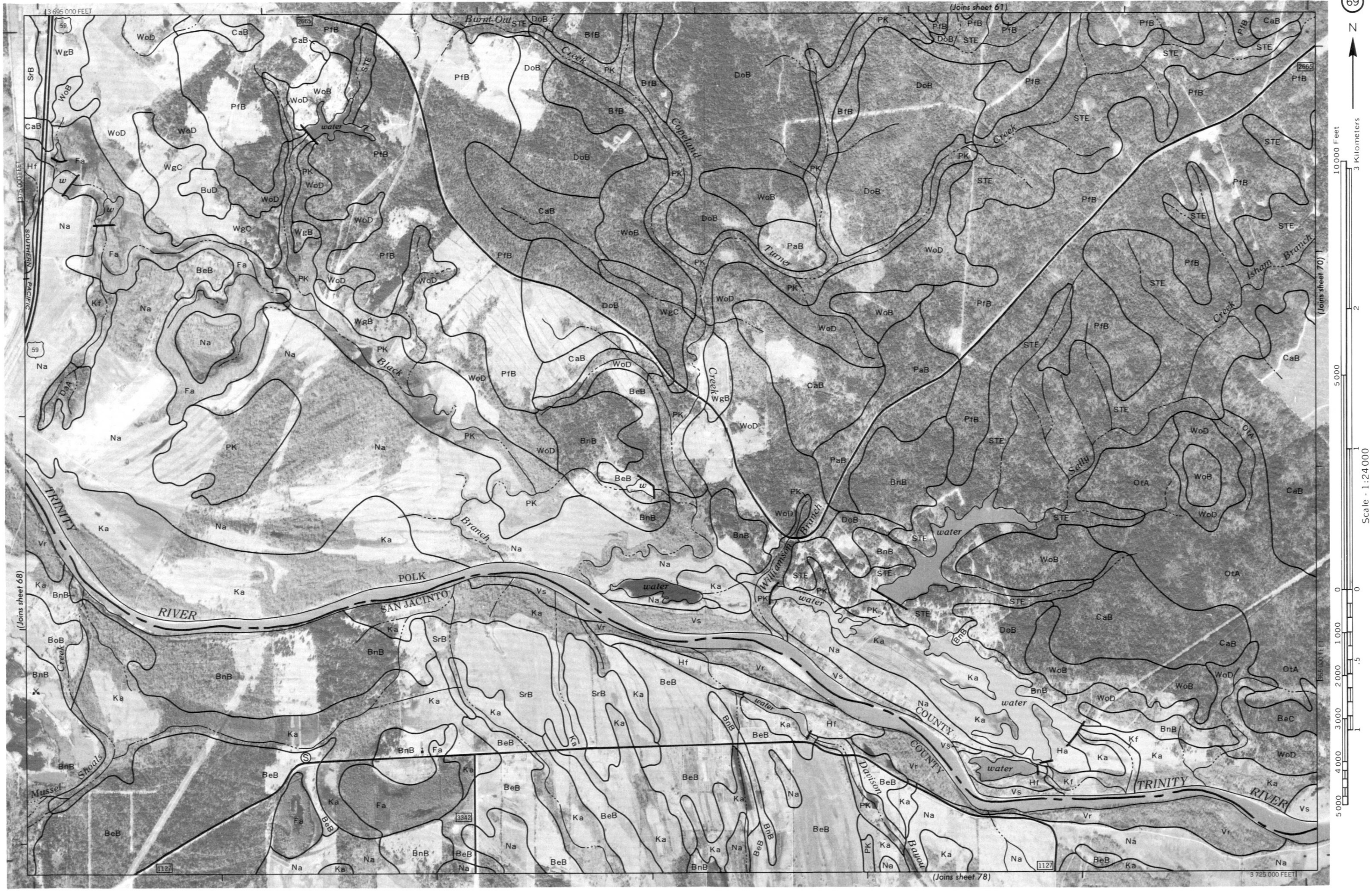

N
(Joins sheet 56)
(Joins sheet 63)
(Joins sheet 72)
(Joins inset A, sheet 22)
Scale 1:24000
10000 Feet
5000
0
1000
2000
3000
4000
5000
3 Kilometers
2
1
0
.5
1
Dallardsville
water
Kimball Creek
Little Kimball Creek
Long Branch
TYLER COUNTY
INDEFINITE BOUNDARY
BoB
PfB
CaB
DoB
DaA
PGB
STE
WaA
PK
OtA
1276


65
(Joins sheet 57)
(Joins sheet 66)
(Joins sheet 74)
(Joins inset A, sheet 23)
SAM HOUSTON NATIONAL FOREST
SAM
HOUSTON
NATIONAL
FOREST
West Fork Caney Creek
East Fork Caney Creek
Caney Creek
Chinquapin Creek
West Fork Pumpkin Creek
East Fork Pumpkin Creek
Pumpkin Creek
Miller Creek
Winters Bayou
Black Branch
Evergreen
Pumpkin
2693
945
150
N
10000 Feet
5000
0
1000
2000
3000
4000
5000
3 Kilometers
2
1
.5
0
Scale - 1:24 000

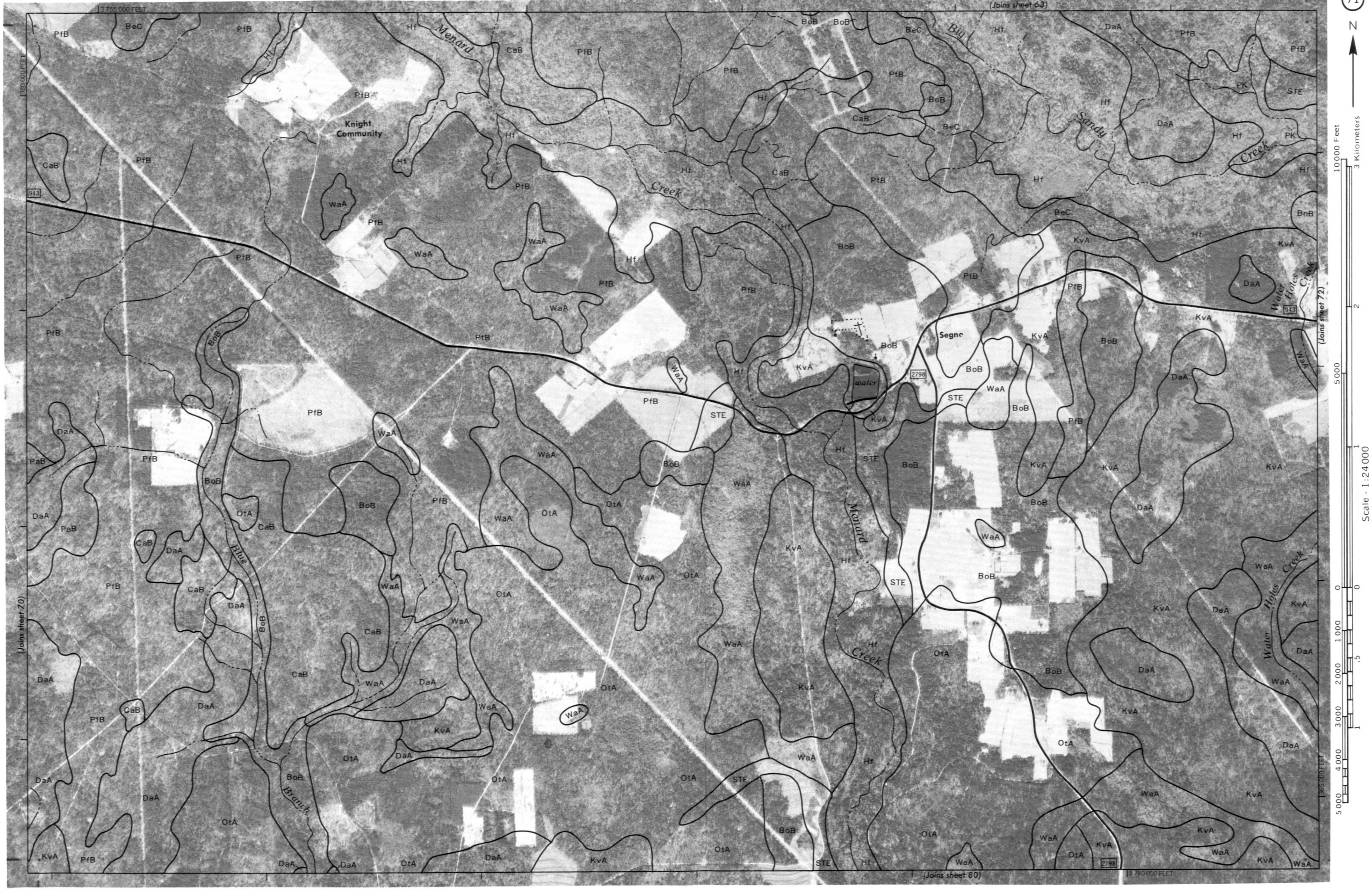

66
N
(Joins sheet 58)
(Joins sheet 65)
(Joins sheet 64)
(Joins sheet 75)
Spring Hill Community
EAST FORK SAN JACINTO RIVER
SAM HOUSTON NATIONAL FOREST
Sand Creek
Ross Branch
Miller Creek
Clear Creek
Double Lake Branch
Double Lake
Scale - 1:24000
10000 Feet
3 Kilometers
5000
1
2
0
.5
1000
2000
3000
4000
5000


(Joins sheet 59)
(Joins sheet 68)
(Joins sheet 76)
(Joins sheet 66)
Coldspring
(county seat)
Evans Lake
Wood Lake
Rosehill
SAM HOUSTON NATIONAL FOREST
SAM
HOUSTON
NATIONAL
FOREST
Williams Creek
Mill Creek
Dry Huffman Creek
Huffman
Huffman Creek
Little Creek
Henry Lake Branch
Double Lake Branch
N
10 000 Feet
3 Kilometers
Scale - 1:24 000

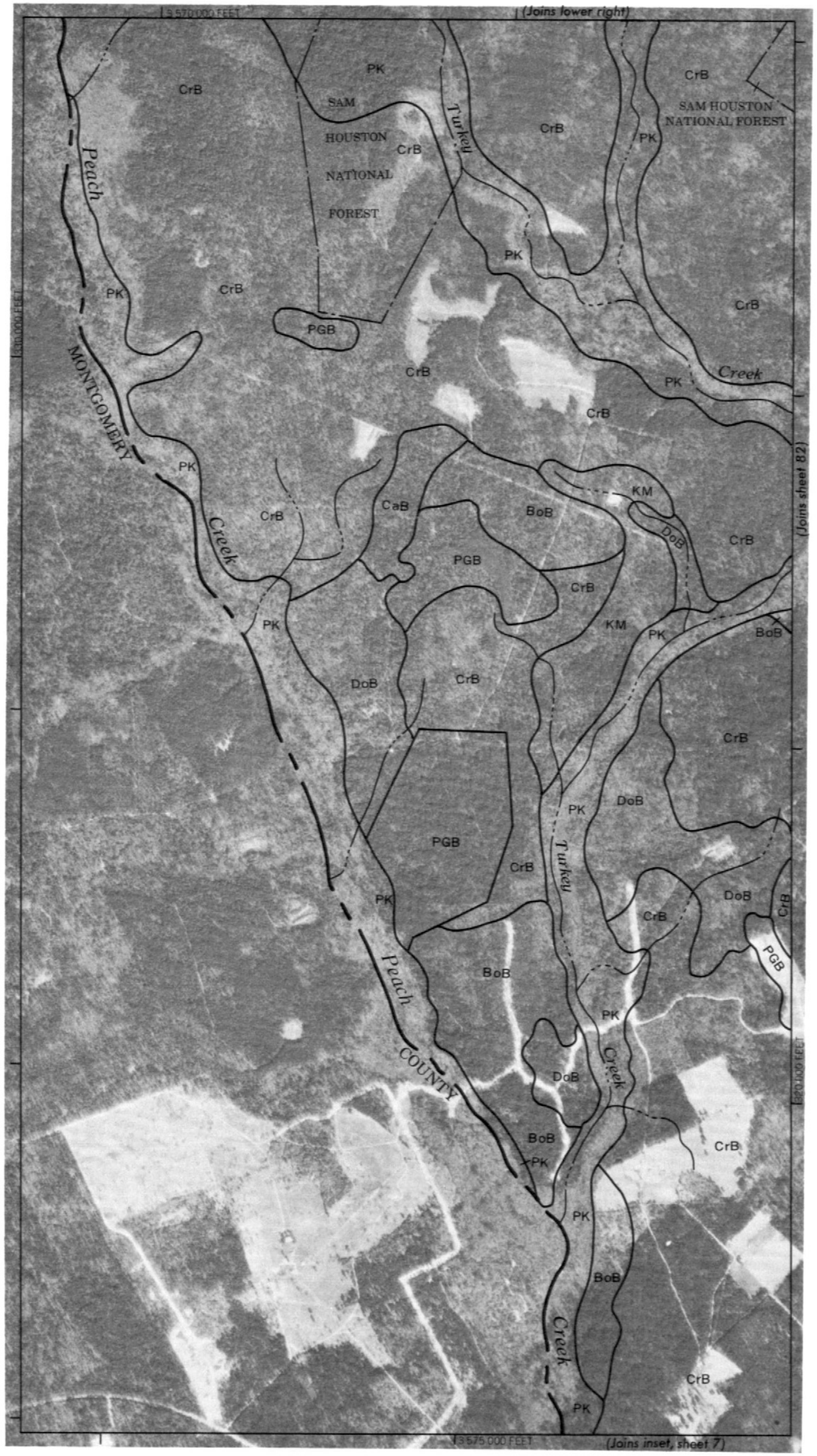

N
Scale - 1:24000
10000 Feet
3 Kilometers
(Joins sheet 60)
(Joins sheet 67)
(Joins sheet 69)
(Joins sheet 77)
TRINITY RIVER
Simon Peter Bend
Simon Bottom
Toms Lake
POLK COUNTY
SAN JACINTO COUNTY
Kf Creek
Huffman Creek
LONG KING CREEK
McCardell Lake
water
Urbana
SOUTHERN PACIFIC
Fish Branch
Mussel Shoals Creek
59
222

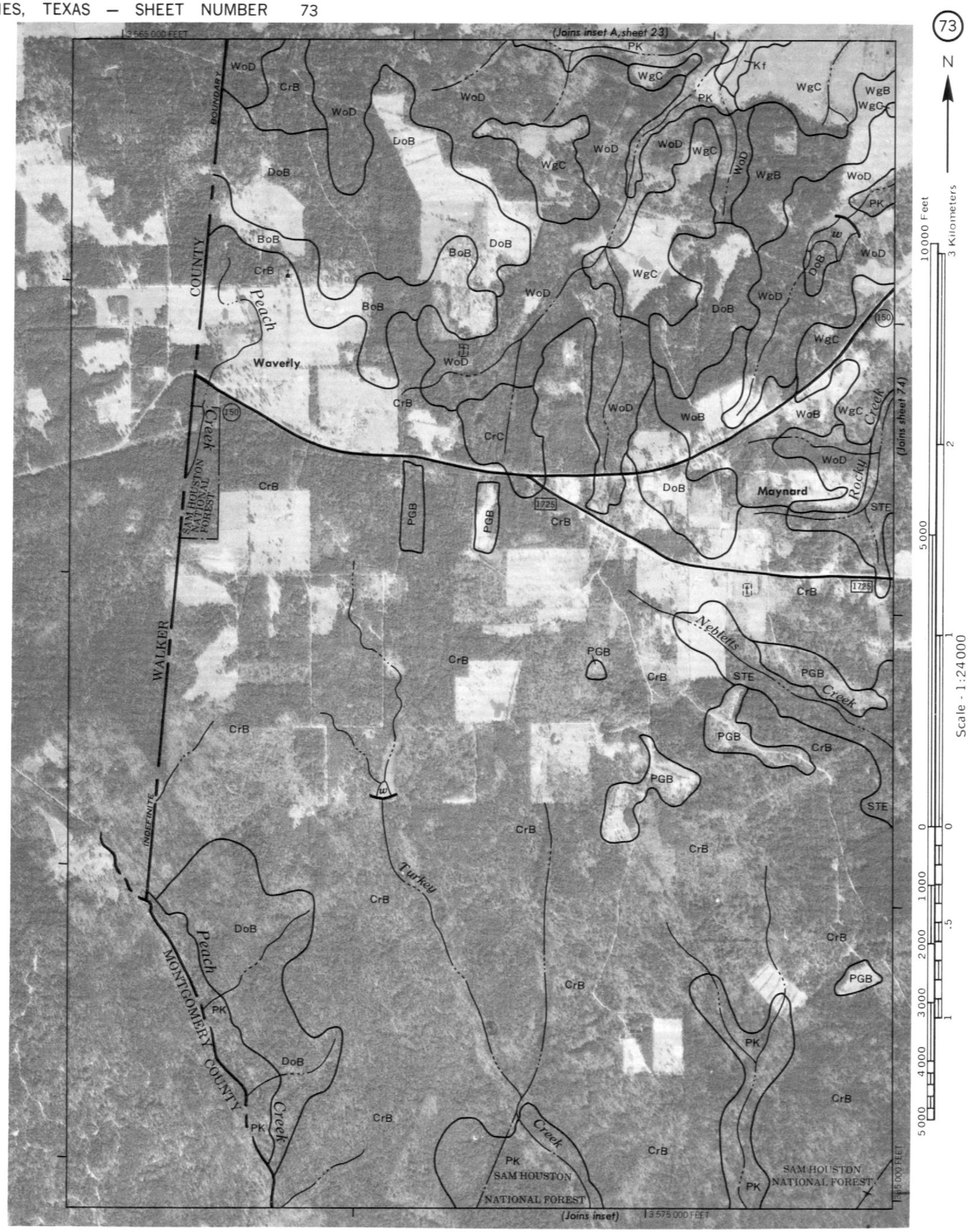

69
N
(Joins sheet 61)
(Joins sheet 70)
(Joins sheet 78)
(Joins sheet 68)
3 695 000 FEET
3 725 000 FEET
375 000 FEET
SOUTHERN PACIFIC
59
2665
3342
1127
Burnt-Out Creek
Copeland Creek
Turner
Black Branch
Williamson Branch
Isham Branch Creek
Sally
Mussel Shoals Creek
Davison Bayou
TRINITY RIVER
POLK COUNTY
SAN JACINTO COUNTY
water
Scale - 1:24 000
10000 Feet
5000
0
3 Kilometers
2
1
.5
0

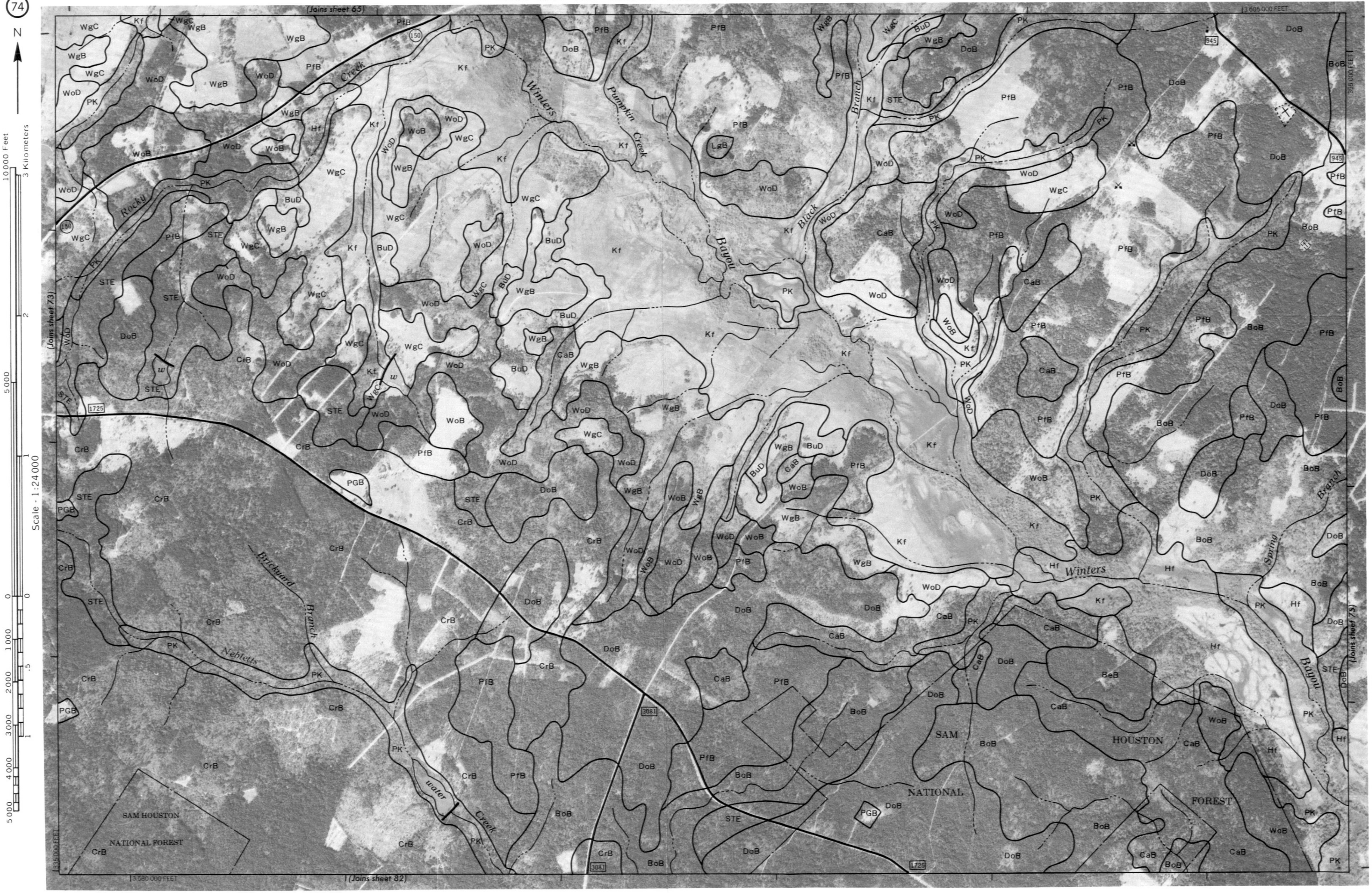

N
Scale - 1:24000
3 Kilometers
10000 Feet
(Joins sheet 62)
(Joins sheet 69)
(Joins sheet 71)
(Joins sheet 79)
3 750 000 FEET
3 729 000 FEET
Schwab City
Sally Creek
Isham Branch
Second Creek
Second Branch
Emanuel Ace
Mill Creek
Waterhole Creek
Williams Creek
POLK COUNTY
SAN JACINTO COUNTY
TRINITY RIVER
146
943
2665
2610
CaB
STE
PfB
WaA
SoA
PK
BoB
PGB
PaB
DaA
OtA
BeC
WoD
WoB
Ka
Vs
Vr
Na
SrD
KvA
DoB

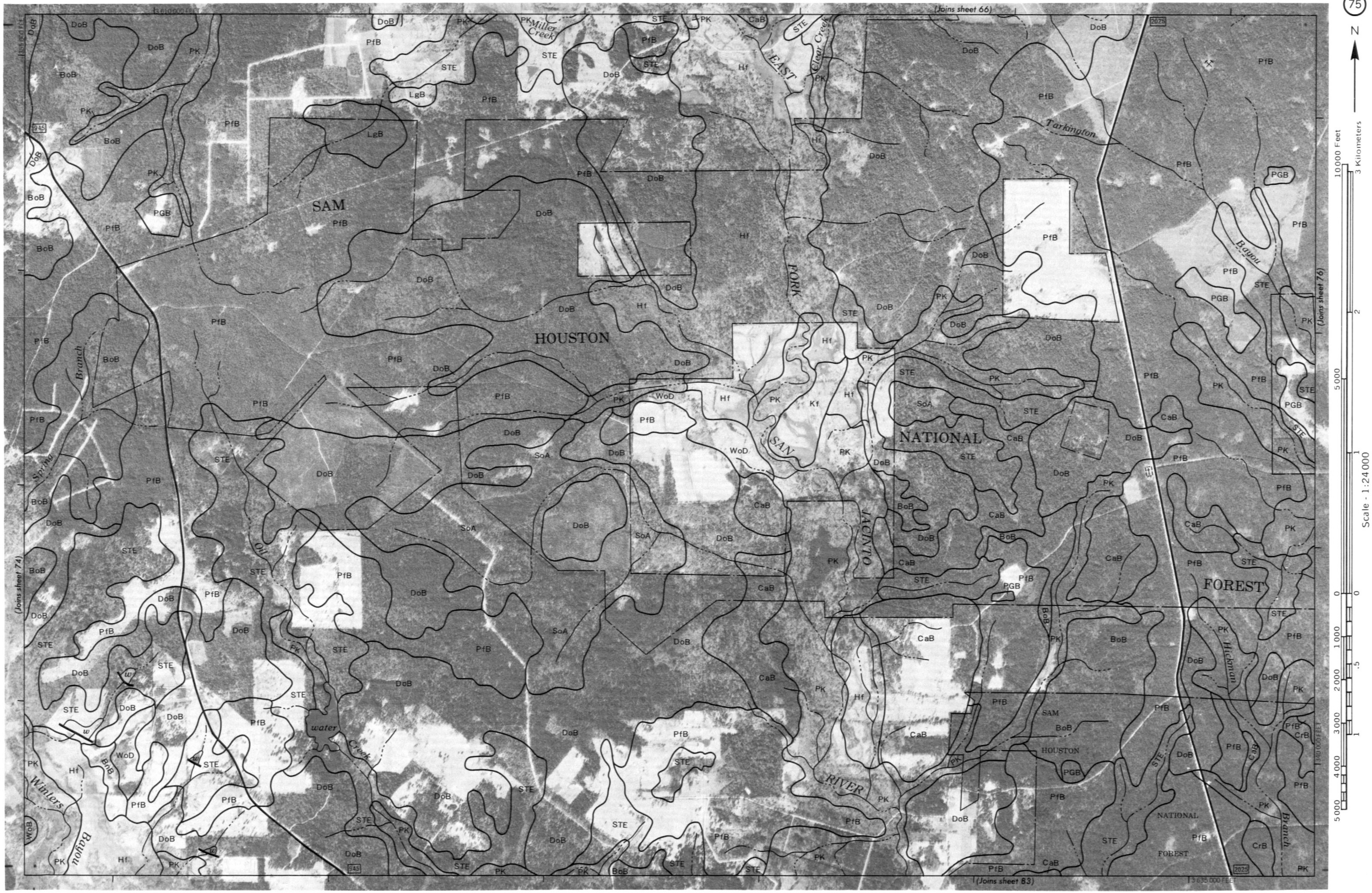

(Joins sheet 63)
(Joins sheet 72)
(Joins sheet 80)
(Joins sheet 70)
3 755 000 FEET
3 780 000 FEET
Knight Community
Segno
Menard Creek
Big Sandy Creek
Blue Branch
Water Holes Creek
water
943
2798
PfB
BeC
CaB
Hf
WaA
BoB
STE
KvA
DaA
OtA
PaB
PK
BnB
N
10 000 Feet
3 Kilometers
Scale - 1:24 000

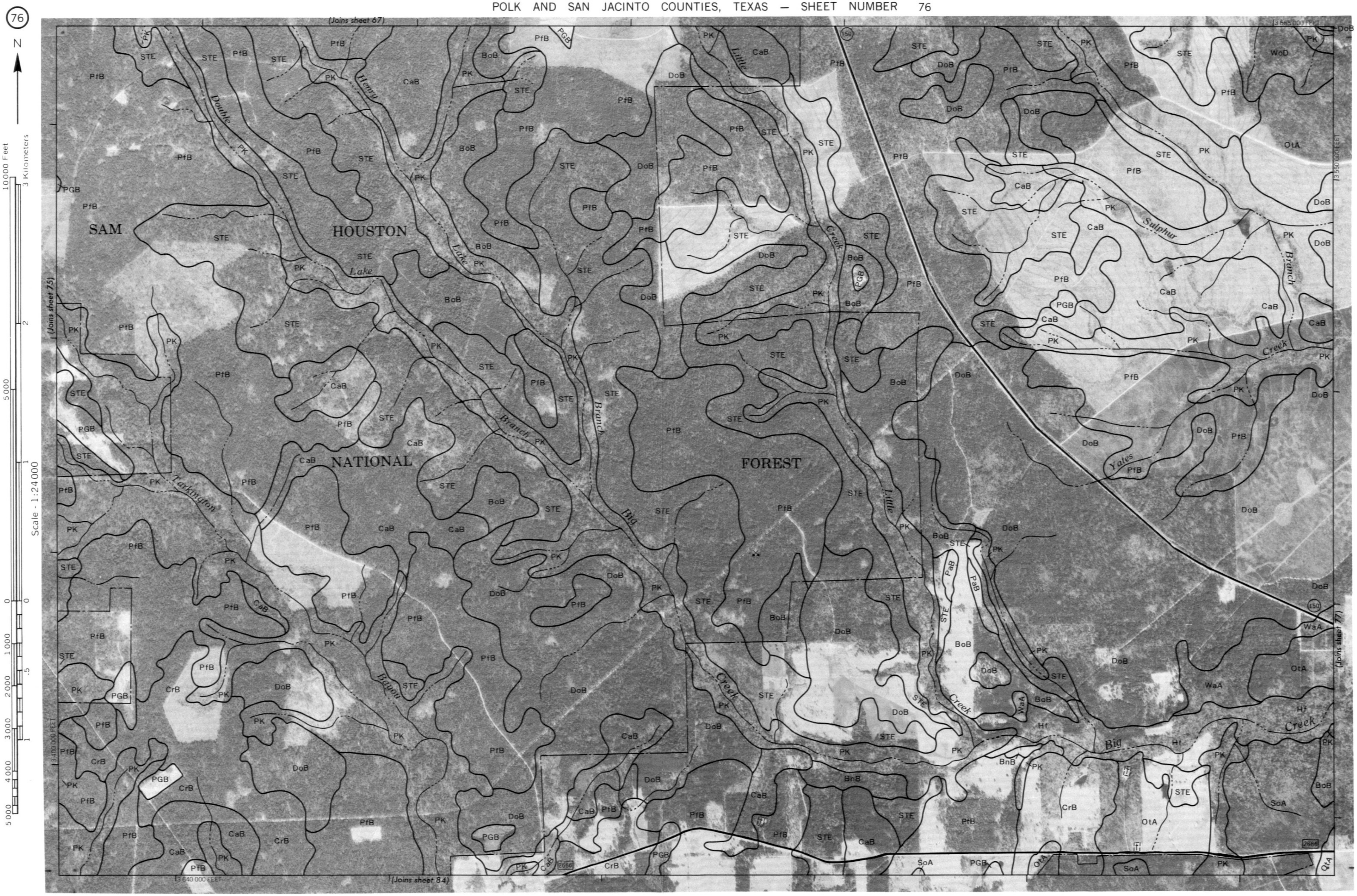

N
(Joins sheet 64)
(Joins sheet 71)
(Joins sheet 81)
(Joins inset, sheet 39)
Scale - 1:24 000
10000 Feet
3 Kilometers
Big Sandy Creek
Kimball Creek
Long Branch
Little Pine Island Bayou
Water Holes Creek
Bad Luck Creek
Cypress Creek


(Joins lower right)
3 570 000 FEET
SAM HOUSTON NATIONAL FOREST
SAM HOUSTON NATIONAL FOREST
Peach Creek
Turkey Creek
MONTGOMERY COUNTY
(Joins sheet 82)
(Joins inset, sheet 7)
3 575 000 FEET
CrB
PK
PGB
CaB
BoB
KM
DoB

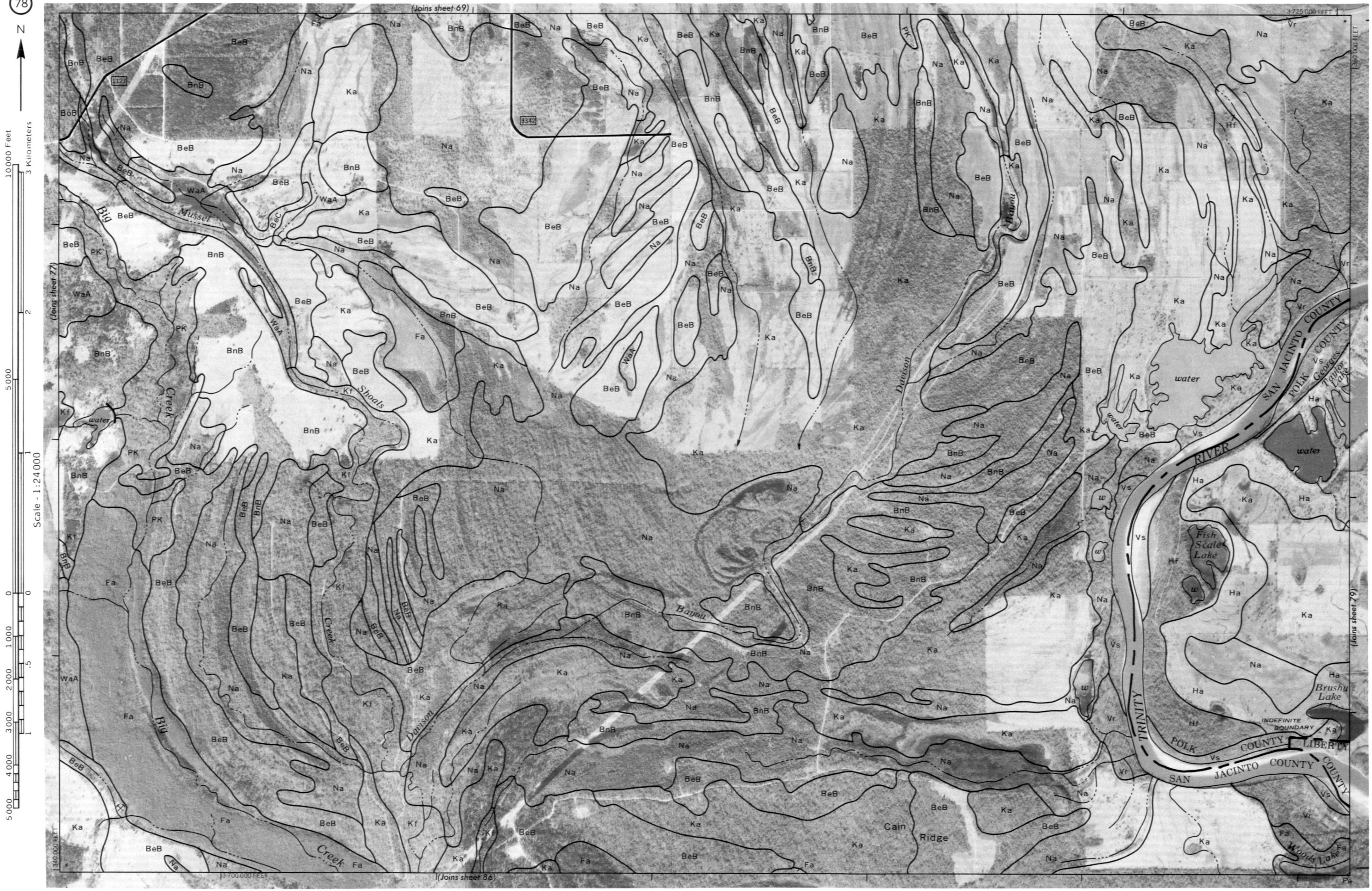

73
N
(Joins inset A, sheet 23)
3 665 000 FEET
WALKER COUNTY BOUNDARY
INDEFINITE
MONTGOMERY COUNTY
SAM HOUSTON NATIONAL FOREST
Waverly
Maynard
Peach Creek
Turkey Creek
Rocky Creek
Nebletts Creek
150
1725
(Joins sheet 74)
(Joins inset)
3 575 000 FEET
SAM HOUSTON NATIONAL FOREST
WoD
CrB
DoB
BoB
WgC
WgB
Kf
PK
WoB
CrC
PGB
STE
w
10 000 Feet
3 Kilometers
Scale - 1:24 000


N
10 000 Feet
3 Kilometers
Scale - 1:24000
(Joins sheet 65)
(Joins sheet 73)
(Joins sheet 75)
(Joins sheet 82)
Rocky Creek
Winters Bayou
Pumpkin Creek
Black Branch
Spring Branch
Brickyard Branch
Nebletts Creek
SAM HOUSTON NATIONAL FOREST
SAM HOUSTON NATIONAL FOREST

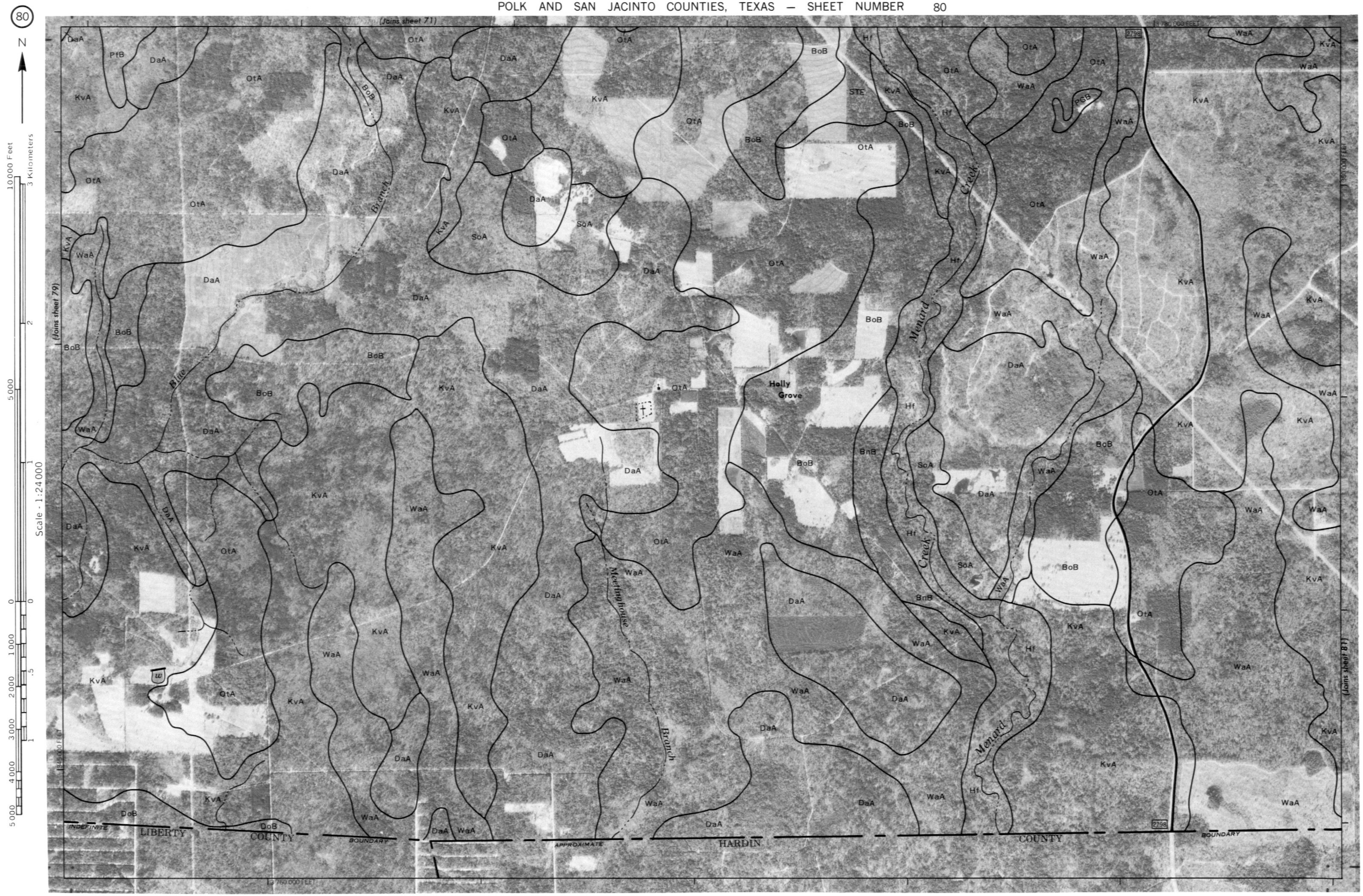

75
N
(Joins sheet 66)
(Joins sheet 76)
(Joins sheet 83)
(Joins sheet 74)
SAM
HOUSTON
NATIONAL
FOREST
EAST
FORK
SAN
JACINTO
RIVER
Miller Creek
Clear Creek
Tarkington
Bayou
Spring
Branch
Oil
Creek
Winters
Bayou
Hickman
Branch
water
945
2025
10 000 Feet
3 Kilometers
Scale - 1:24000

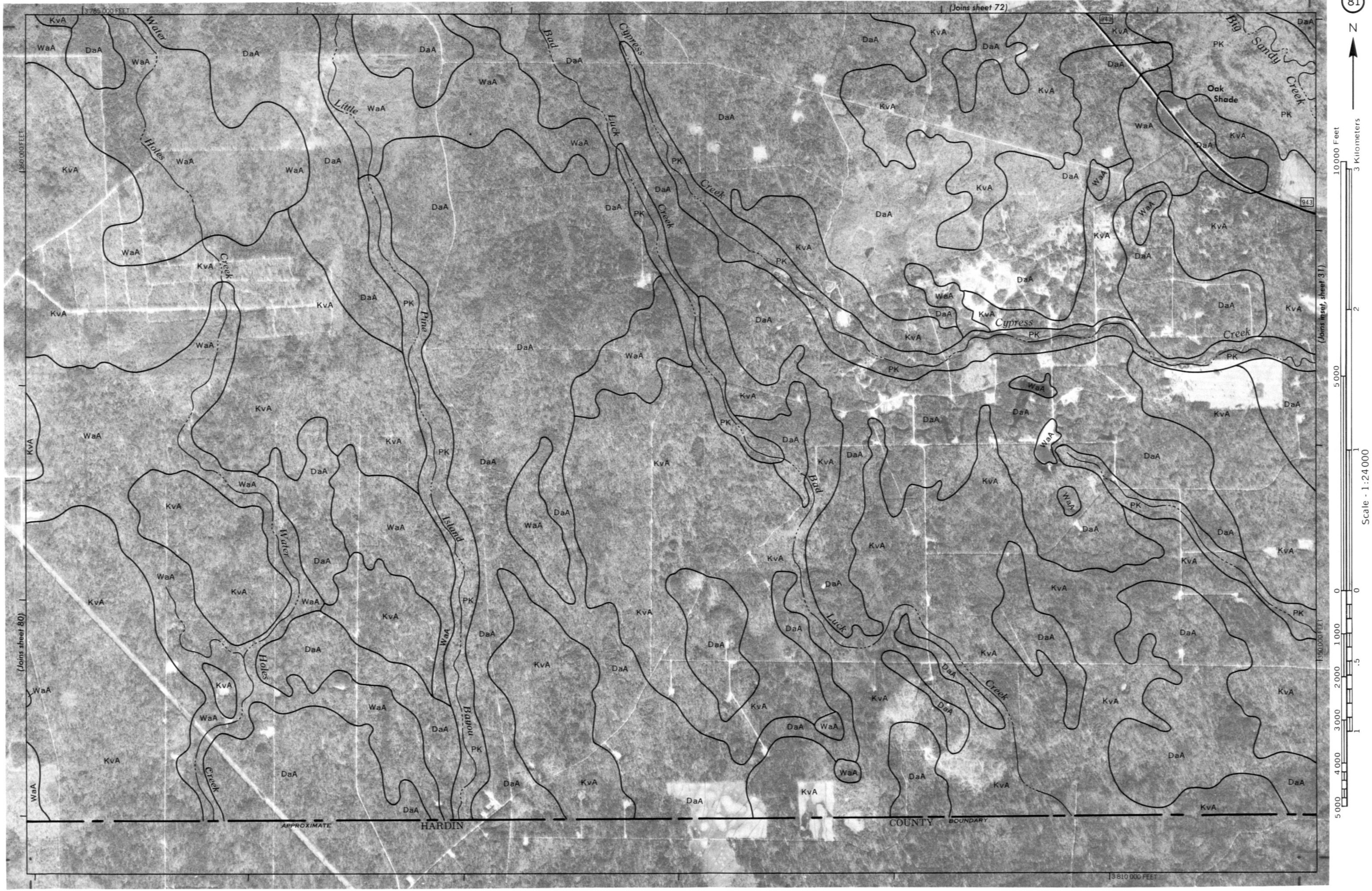

76
N
(Joins sheet 67)
(Joins sheet 75)
(Joins sheet 77)
(Joins sheet 84)
SAM
HOUSTON
NATIONAL
FOREST
Double Lake
Henry Lake Branch
Big Branch
Little Creek
Tarkington Bayou
Big Creek
Sulphur Branch
Yates
Creek
Scale - 1:24000
10000 Feet
3 Kilometers
150
2666

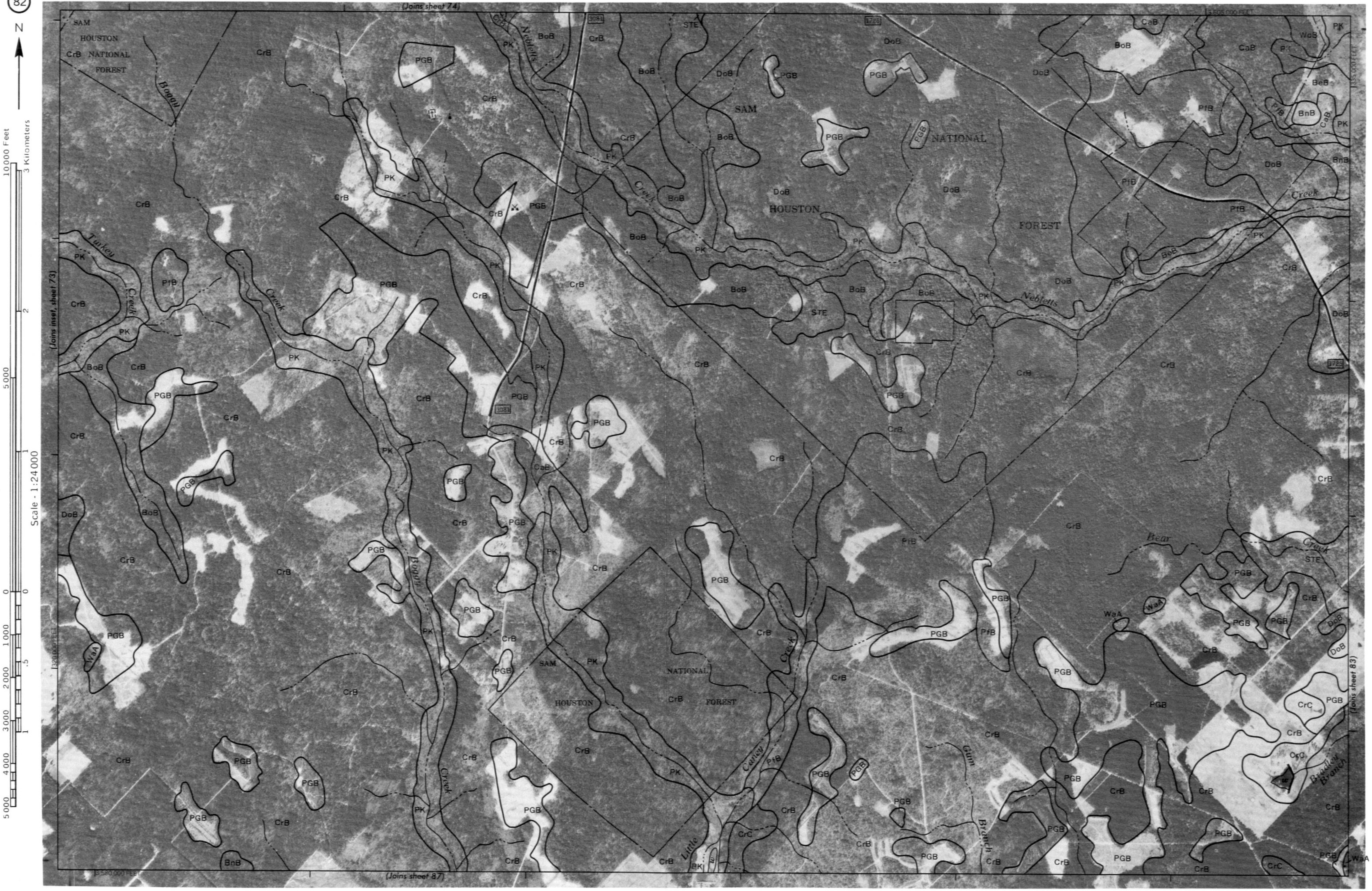

77
N
(Joins sheet 68)
(Joins sheet 78)
(Joins sheet 76)
(Joins sheet 85)
Huffman Creek
Yates
Big Creek
Big
Mussel Shoals Creek
Shepherd
PACIFIC
SOUTHERN
water
3 Kilometers
10000 Feet
Scale - 1:24000

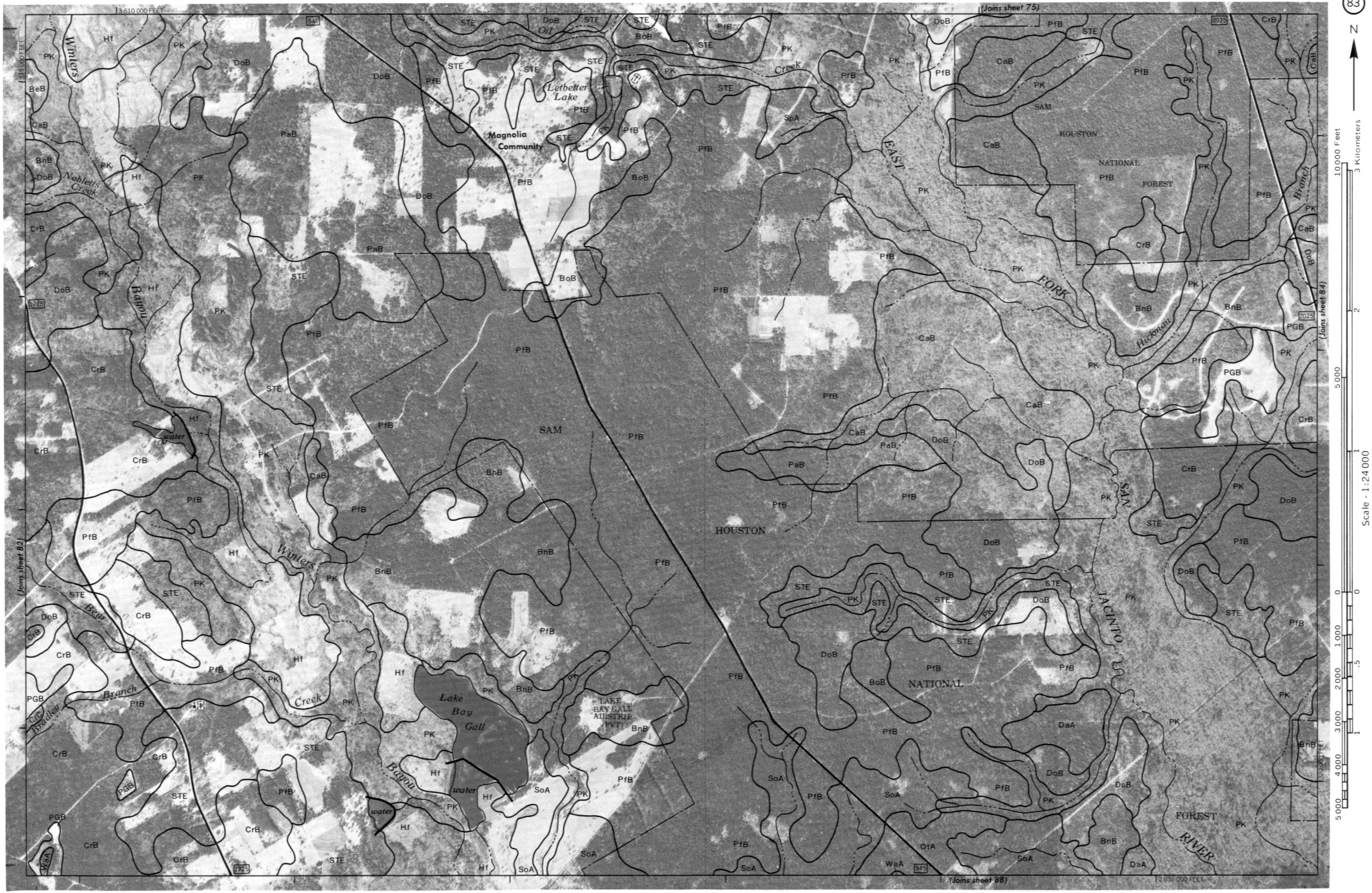

N
Scale - 1:24000
10000 Feet
5000
0
1000
2000
3000
4000
5000
3 Kilometers
2
1
.5
0
(Joins sheet 69)
(Joins sheet 77)
(Joins sheet 79)
(Joins sheet 86)
3 725 000 FEET
3 700 000 FEET
340 000 FEET
1127
3342
Big Musset Shoals
Big Creek
Davison Creek
Davison Bayou
Bayou
Cain Ridge
water
w
TRINITY RIVER
SAN JACINTO COUNTY
POLK COUNTY
LIBERTY COUNTY
INDEFINITE BOUNDARY
Georges Taylor Lake
Fish Scale Lake
Brushy Lake
Woods Lake
BeB
BnB
BeC
BoB
Fa
Ha
Hf
Ka
Kf
Na
PK
Vr
Vs
WaA


79
N
(Joins sheet 70)
(Joins sheet 80)
(Joins sheet 78)
(Joins inset, sheet 16)
3 725 000 FEET
3 755 000 FEET
TRINITY RIVER
SAN JACINTO COUNTY
POLK COUNTY
LIBERTY COUNTY BOUNDARY
INDEFINITE
George Taylor Lake
Munson Lake
Duke Lake
Brushy Lake
Woods Lake
Williams Creek
Mill Creek
Waterhole Creek
Blue Branch
ACE
water
2610
146
Scale - 1:24 000
10 000 Feet
3 Kilometers


80
N
(Joins sheet 71)
(Joins sheet 79)
(Joins sheet 81)
Scale - 1:24000
10000 Feet
3 Kilometers
Holly Grove
Blue Branch
Menard Creek
Meetinghouse Branch
LIBERTY COUNTY
HARDIN COUNTY
INDEFINITE BOUNDARY
APPROXIMATE BOUNDARY
2798

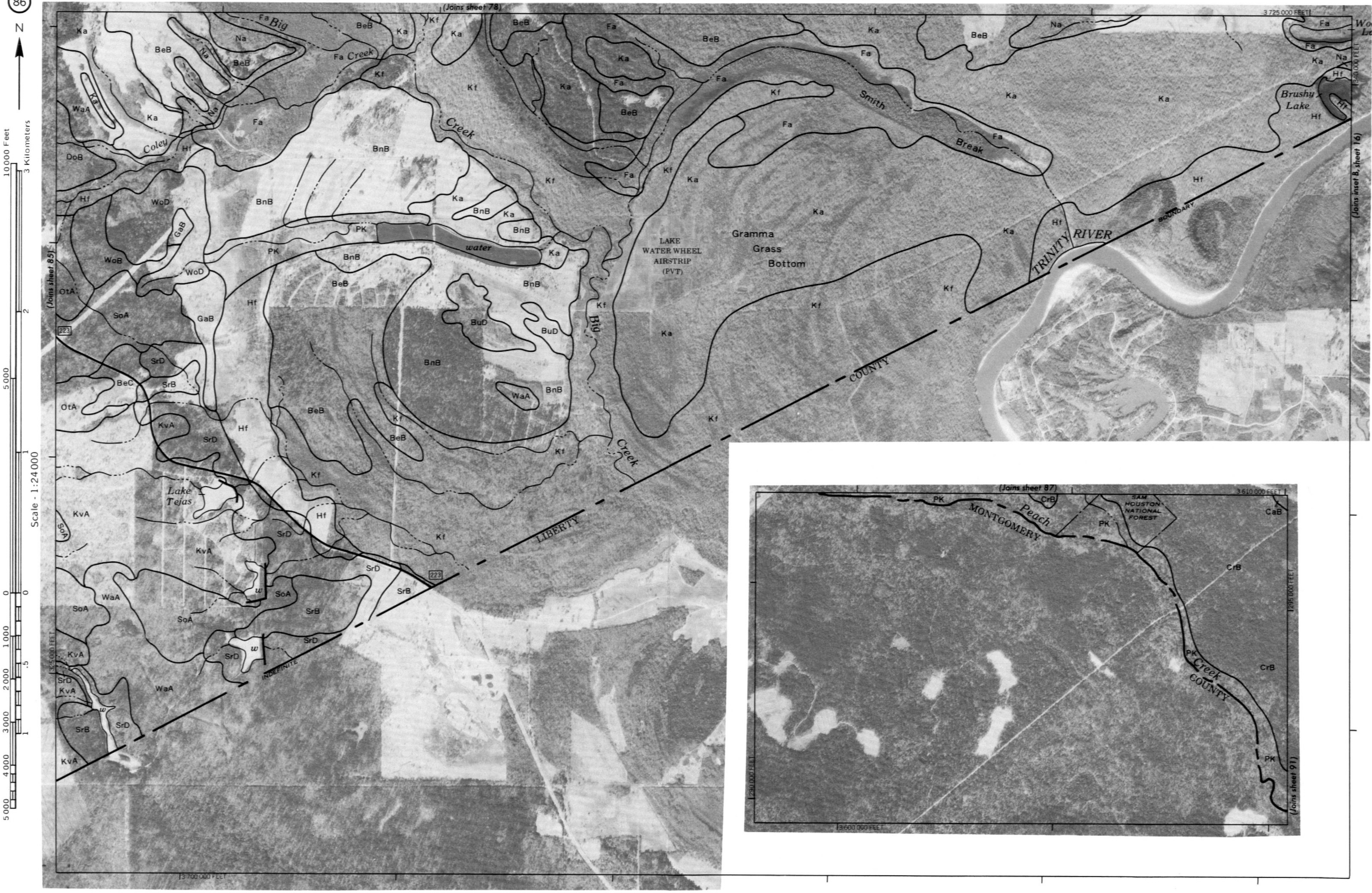

81
N
(Joins sheet 72)
(Joins sheet 80)
(Joins inset, sheet 31)
3 785 000 FEET
350 000 FEET
3 810 000 FEET
943
Oak Shade
Big Sandy Creek
Cypress Creek
Bad Luck Creek
Little Pine Island Bayou
Water Holes Creek
APPROXIMATE HARDIN COUNTY BOUNDARY
DaA
KvA
WaA
PK
10 000 Feet
3 Kilometers
5000
0
1000
2000
3000
4000
5000
2
1
.5
Scale - 1:24 000

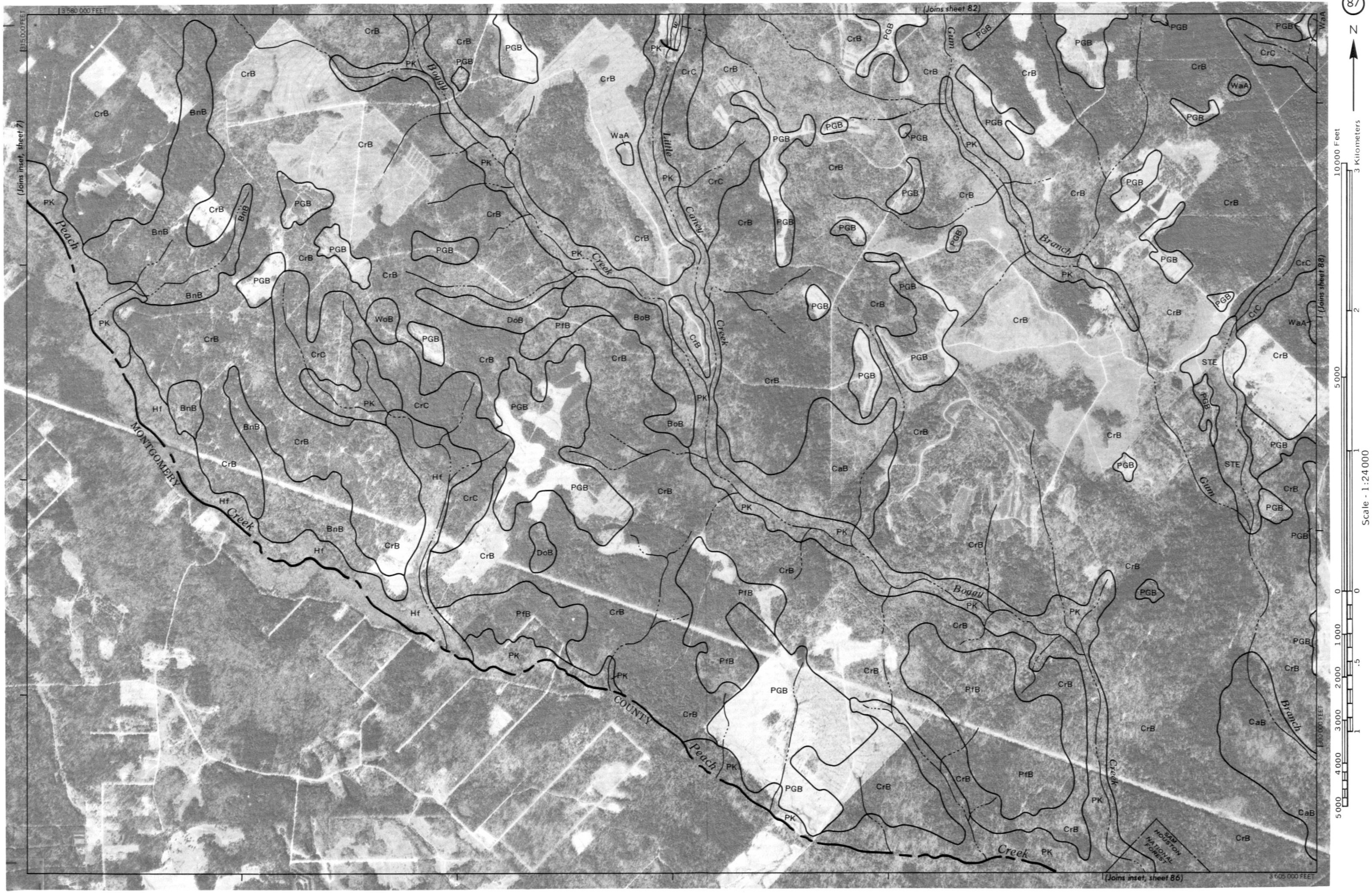

N
10000 Feet
3 Kilometers
Scale - 1:24000
(Joins sheet 74)
(Joins sheet 87)
(Joins inset, sheet 73)
(Joins sheet 83)
SAM HOUSTON NATIONAL FOREST
SAM HOUSTON NATIONAL FOREST
SAM HOUSTON NATIONAL FOREST
Turkey Creek
Boggy Creek
Nebletts Creek
Bear Creek
Little Caney Creek
Gum Branch
Bradley Branch
3081
1725
CrB
PGB
PK
BoB
DoB
PfB
CaB
WaA
BnB
BeB
WoB
STE
CrC

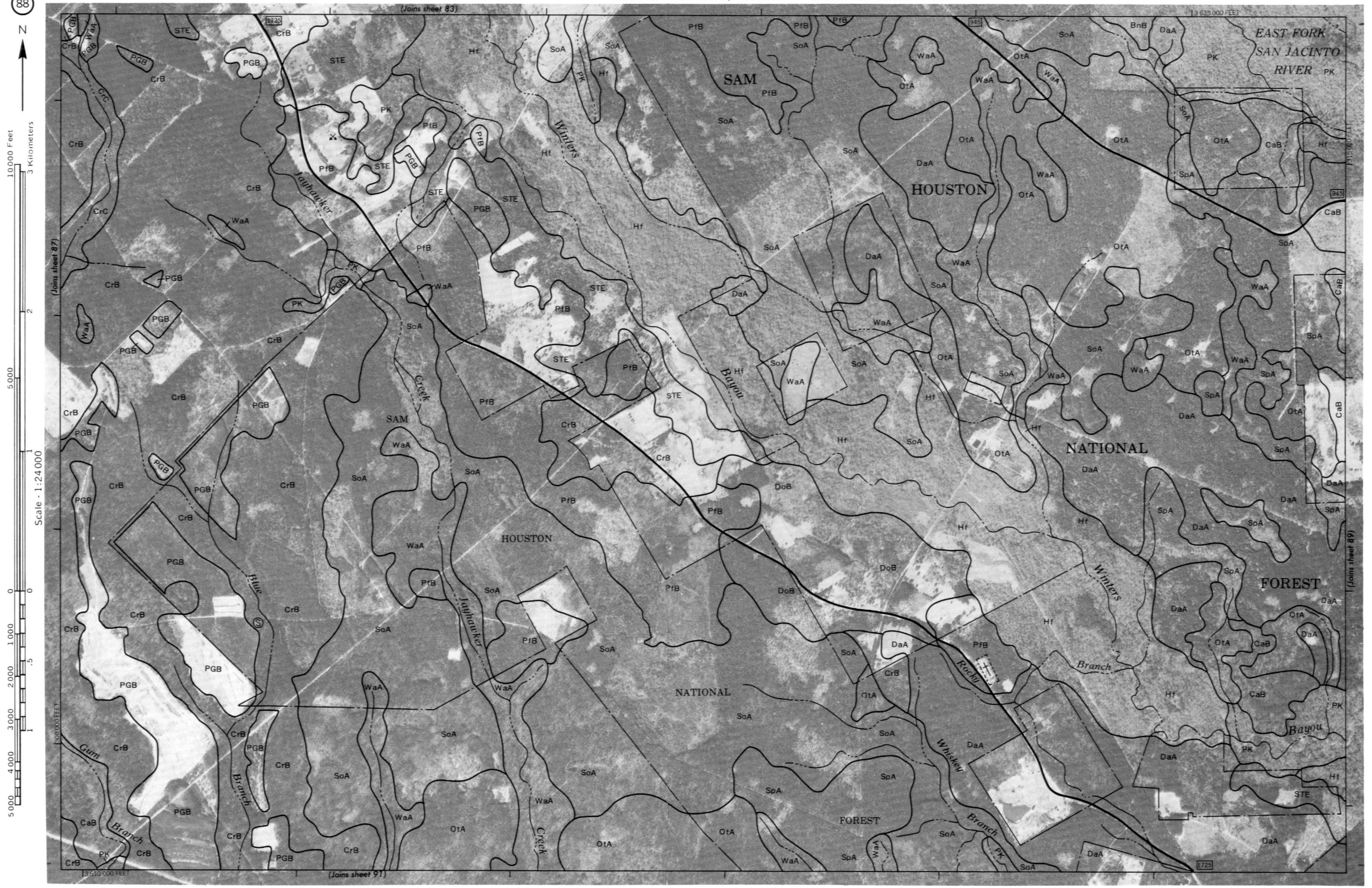

83
N
(Joins sheet 75)
(Joins sheet 84)
(Joins sheet 88)
(Joins sheet 82)
3 610 000 FEET
3 630 000 FEET
Magnolia Community
Letbetter Lake
Oil Creek
EAST FORK
SAN JACINTO RIVER
Hickman Branch
Winters Bayou
Winters Creek
Nebletts Creek
Bear Creek
Bradley Branch
Lake Bay Gall
LAKE BAY GALL AIRSTRIP (PVT)
SAM HOUSTON NATIONAL FOREST
water
945
1725
2025
PK
Hf
DoB
BeB
CaB
BnB
CrB
STE
PfB
PaB
BoB
SpA
CaB
PGB
SoA
DaA
DaB
OtA
WaA
10000 Feet
3 Kilometers
5000
Scale - 1:24 000
0
1000
2000
3000
4000
5000
.5
1
2


84
N
10000 Feet
3 Kilometers
Scale - 1:24 000
(Joins sheet 76)
(Joins sheet 83)
(Joins sheet 85)
(Joins sheet 89)
3 665 000 FEET
3 640 000 FEET
335 000 FEET
320 000 FEET
SAM
HOUSTON
NATIONAL
FOREST
Hickman Branch
Tarkington
Tarkington
Bayou
Bayou
2025
2666
PK
PfB
CaB
CrB
PGB
BoB
DoB
STE
SoA
KvA
OtA
WaA
GaB
BnB

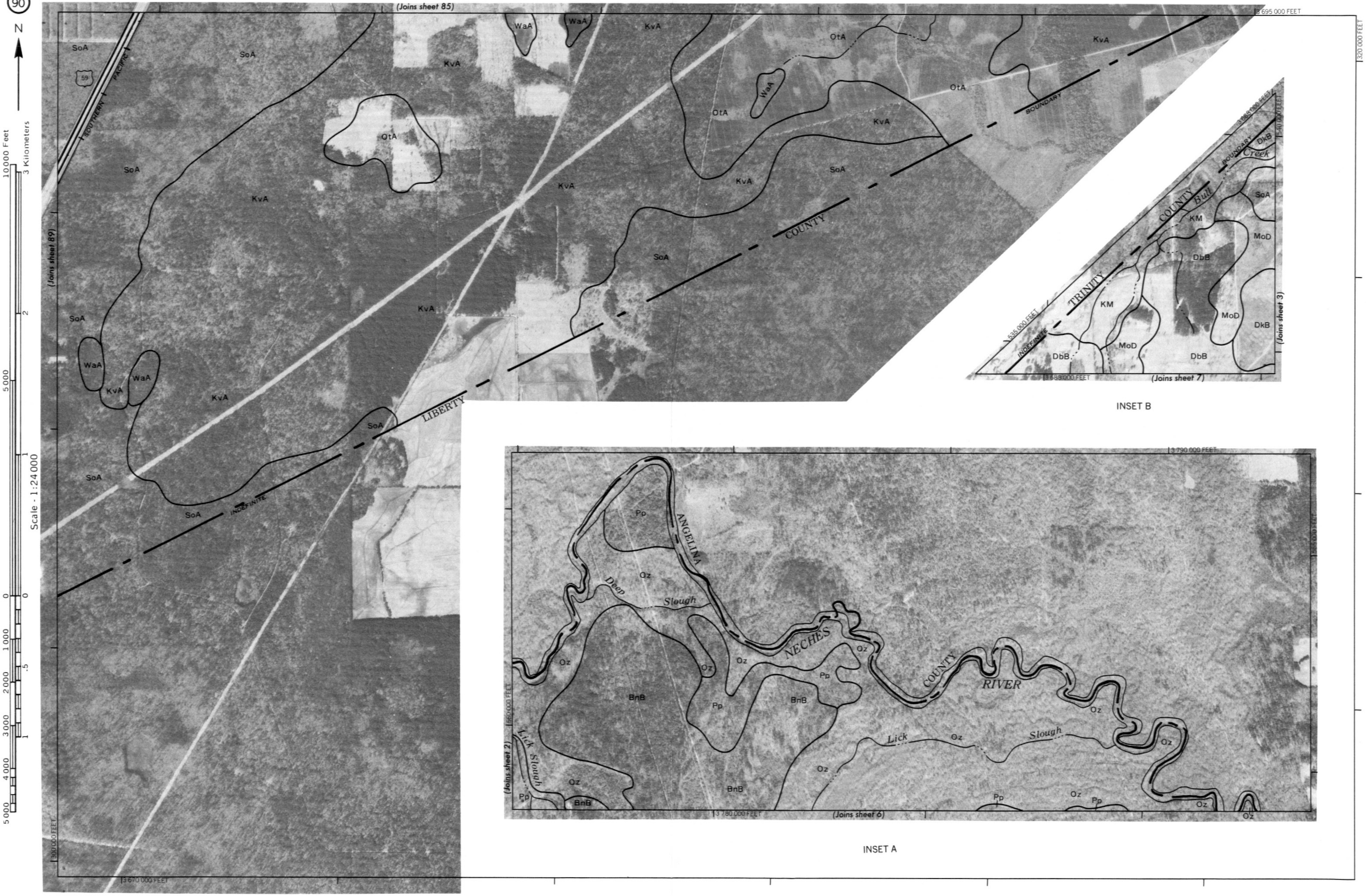

85
N
(Joins sheet 77)
(Joins sheet 90)
(Joins sheet 84)
(Joins sheet 86)
3 670 000 FEET
3 695 000 FEET
SAM HOUSTON
NATIONAL FOREST
LIBERTY COUNTY
INDEFINITE
BOUNDARY
PACIFIC
SOUTHERN
Coley
Creek
Dry
Cherry
water
59
424
223
2914
OtA
SoA
KvA
BoB
BnB
CaB
PaB
WaA
WoB
DaA
PK
PtB
DoB
Ka
Ht
SrD
SrB
Scale - 1:24 000
10 000 Feet
3 Kilometers
5000
1000
2000
3000
4000
0
.5
1
2

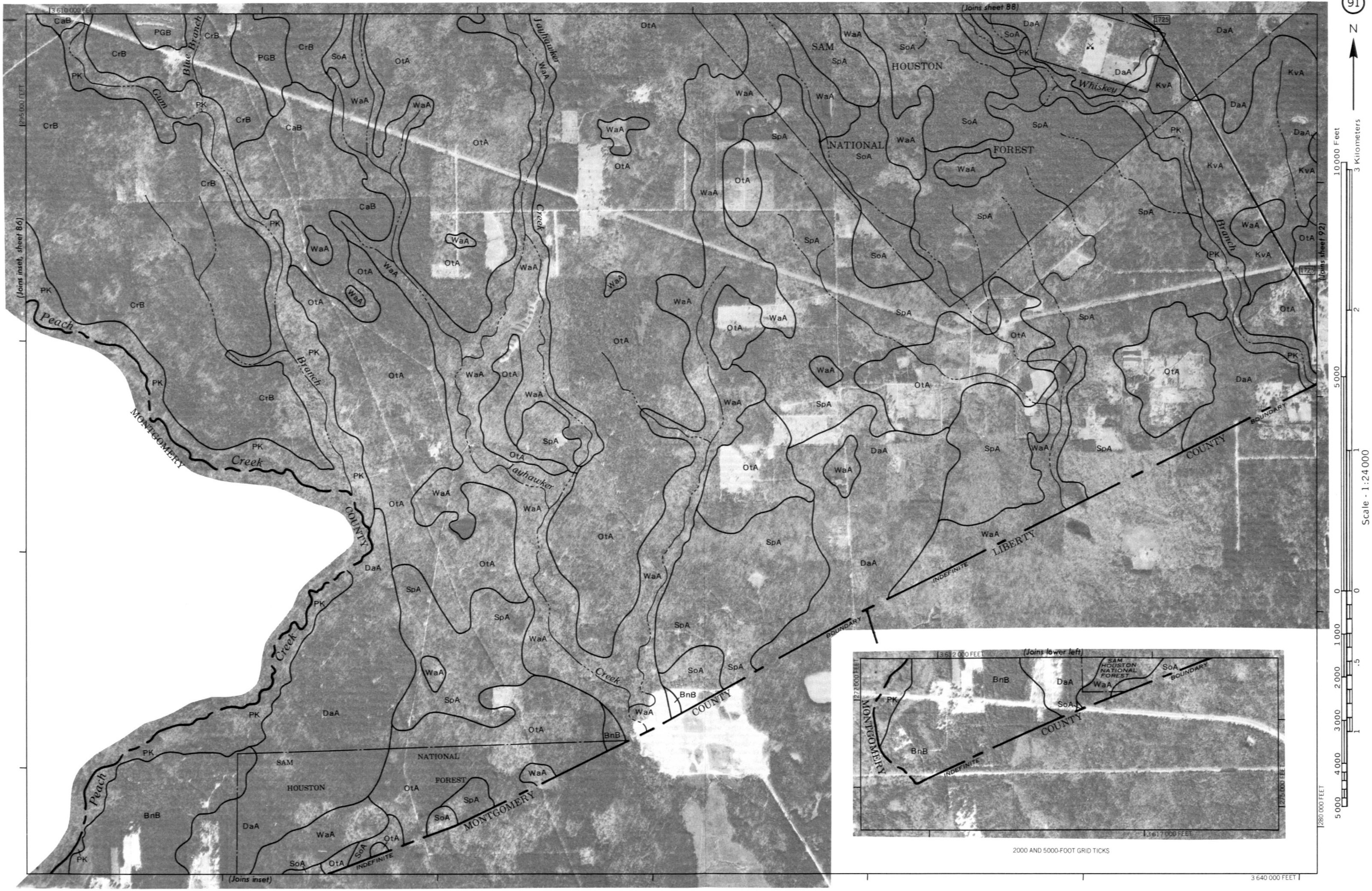

N
10 000 Feet
3 Kilometers
Scale - 1:24000
(Joins sheet 78)
(Joins sheet 85)
(Joins inset B, sheet 16)
(Joins sheet 87)
(Joins sheet 91)
3 725 000 FEET
3 700 000 FEET
3 610 000 FEET
3 600 000 FEET
Big Creek
Coley
Smith Break
Woods Lake
Brushy Lake
water
LAKE WATER WHEEL AIRSTRIP (PVT)
Gramma Grass Bottom
TRINITY RIVER
BOUNDARY
LIBERTY COUNTY
INDEFINITE
Lake Tejas
223
MONTGOMERY COUNTY
Peach Creek
SAM HOUSTON NATIONAL FOREST


3 580 000 FEET
315 000 FEET
(Joins sheet 82)
(Joins inset, sheet 7)
(Joins sheet 88)
(Joins inset, sheet 86)
3 605 000 FEET
290 000 FEET
N
Scale - 1:24000
10000 Feet
5000
0
1000
2000
3000
4000
5000
3 Kilometers
2
1
.5
0
Peach
Creek
MONTGOMERY
COUNTY
Boggy
Creek
Little
Caney
Creek
Gum
Branch
SAM HOUSTON NATIONAL FOREST
PK
CrB
CrC
PGB
BnB
Hf
WaA
WoB
DoB
PfB
BoB
CaB
STE

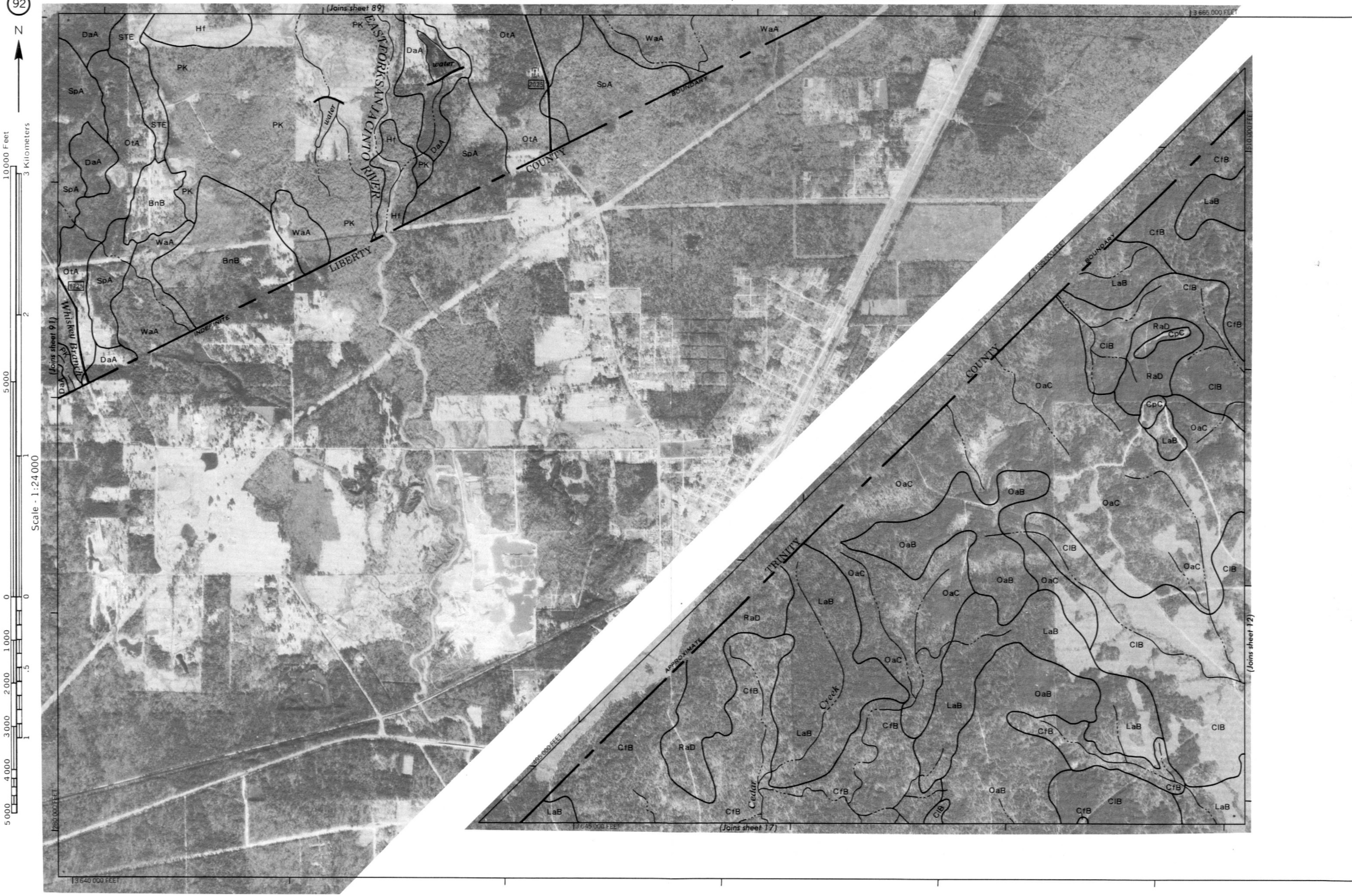

N
Scale - 1:24000
10000 Feet
3 Kilometers
(Joins sheet 83)
(Joins sheet 87)
(Joins sheet 89)
(Joins sheet 91)
3 635 000 FEET
3 610 000 FEET
EAST FORK
SAN JACINTO
RIVER
SAM
HOUSTON
NATIONAL
FOREST
Winters
Bayou
Jayhawker
Creek
Blue
Branch
Gum
Rocky
Whiskey
1725
945


(Joins sheet 84)
(Joins sheet 90)
(Joins sheet 92)
(Joins sheet 88)
3 640 000 FEET
3 665 000 FEET
315 000 FEET
N
EAST FORK SAN JACINTO
SAM HOUSTON NATIONAL FOREST
Winters Bayou
RIVER
Tarkington Bayou
Westcott
water
SOUTHERN PACIFIC
LIBERTY COUNTY BOUNDARY
INDEFINITE
2025
945
59
Scale - 1:24 000
10000 Feet
5000
0
1000
2000
3000
4000
5000
3 Kilometers
2
1
.5
0
1


N
Scale - 1:24 000
3 Kilometers
10 000 Feet
(Joins sheet 85)
(Joins sheet 89)
SOUTHERN PACIFIC
59
SoA
KvA
OtA
WaA
LIBERTY
COUNTY
BOUNDARY
INDEFINITE
3 695 000 FEET
320 000 FEET
300 000 FEET
3 670 000 FEET
TRINITY
COUNTY
BOUNDARY
INDEFINITE
Bull
Creek
KM
DbB
DkB
MoD
535 000 FEET
(Joins sheet 3)
(Joins sheet 7)
INSET B
ANGELINA
NECHES
COUNTY
RIVER
Deep
Slough
Lick
Slough
Pp
Oz
BnB
3 790 000 FEET
3 780 000 FEET
(Joins sheet 2)
(Joins sheet 6)
INSET A



(Joins sheet 88)
(Joins inset, sheet 86)
(Joins sheet 92)
(Joins inset)
(Joins lower left)
3 610 000 FEET
295 000 FEET
3 640 000 FEET
3 612 000 FEET
272 000 FEET
275 000 FEET
280 000 FEET
3 617 000 FEET
1725
SAM HOUSTON NATIONAL FOREST
Whiskey Branch
Blue Branch
Gum Branch
Jayhawker Creek
Peach Creek
MONTGOMERY COUNTY
LIBERTY COUNTY
INDEFINITE BOUNDARY
CaB
CrB
PGB
PK
SoA
OtA
WaA
SpA
DaA
KvA
BnB
2000 AND 5000-FOOT GRID TICKS
N
10000 Feet
3 Kilometers
Scale - 1:24 000


N
10 000 Feet
3 Kilometers
Scale - 1:24 000
(Joins sheet 89)
(Joins sheet 91)
(Joins sheet 12)
(Joins sheet 17)
EAST FORK SAN JACINTO RIVER
Whiskey Branch
LIBERTY COUNTY BOUNDARY
INDEFINITE
TRINITY COUNTY BOUNDARY
APPROXIMATE
Cedar Creek
water
2025
1725
3 665 000 FEET
300 000 FEET
3 640 000 FEET
3 645 000 FEET
280 000 FEET
DaA
STE
Hf
PK
OtA
WaA
SpA
BnB
CfB
ClB
LaB
RaD
CpC
OaC
OaB